VOLUME 70 [W. B. No. 1348] NUMBER 1

UNITED STATES DEPARTMENT OF COMMERCE
JESSE H. JONES, *Secretary*
WEATHER BUREAU - - F. W. Reichelderfer, *Chief*

MONTHLY WEATHER REVIEW

JANUARY 1942

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CORRECTIONS

MONTHLY WEATHER REVIEW, May 1919, vol. 47, page 302, table 2, Porto Bello, the date in the second column should be "November 29, 1911", as recorded in table 1 on the preceding page.

MONTHLY WEATHER REVIEW, December 1941, vol. 69, page 357, the date "May 1, 1908" following Porto Bello should be eliminated; also, the legend to the figure should be deleted.

Recipients of the April, 1941 MONTHLY WEATHER REVIEW are requested to replace Charts VIII-XI, inclusive, in that issue, which were incorrectly printed, by the corrected charts herewith.

Chart VIII. Isobars (mb) for 1,524 Meters (5,000 ft.) and Isotherms (°C.) and Resultant Winds for 1,500 Meters (m. s. l.) April 1941

Isobars and isotherms based on radiosonde observations at 12:30 a. m. (E. S. T.) and winds based on pilot-balloon observations at 5:00 a. m. (E. S. T.).

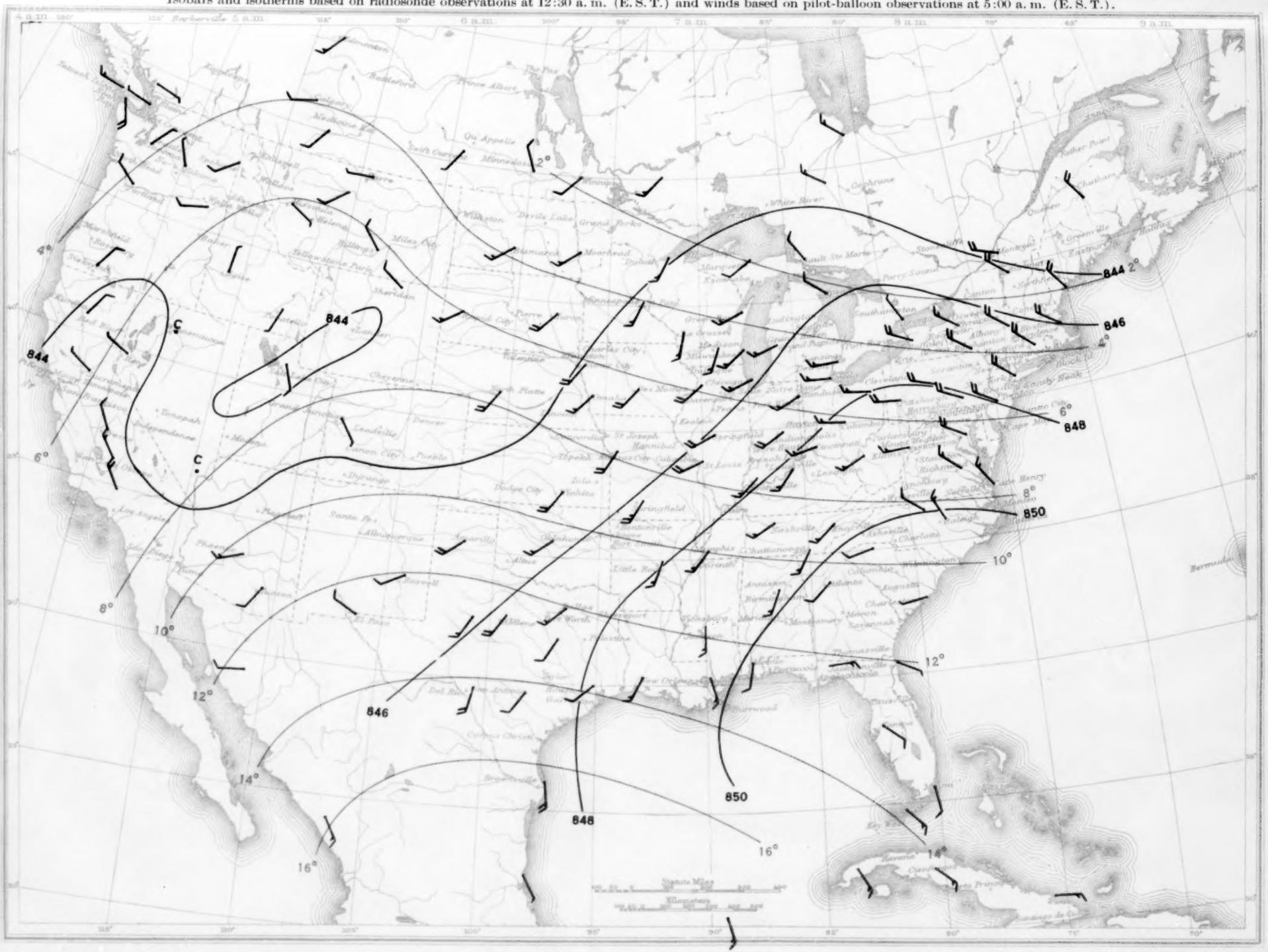


Chart IX. Isobars (mb) Isotherms (°C.) 1:00 a.m. (E.S.T) and Resultant Winds 5:00 a.m. (E.S.T.) for 3,000 Meters (m.s.l.) April 1941

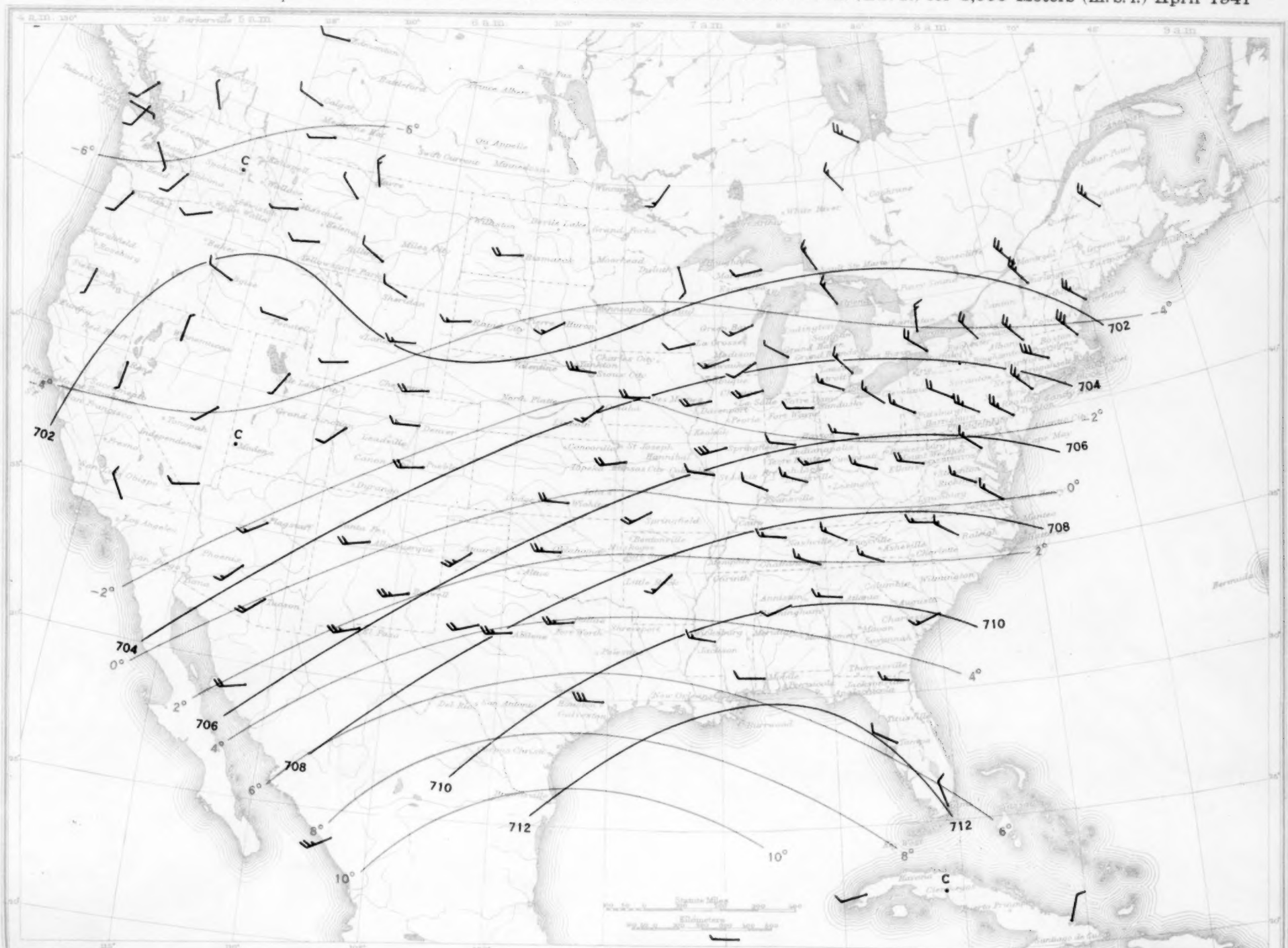


Chart X. Isobars (mb) Isotherms (°C.) 1:00 a.m. (E.S.T.) and Resultant Winds 5:00 p.m. (E.S.T.) for 5,000 Meters (m.s.l.) April 1941

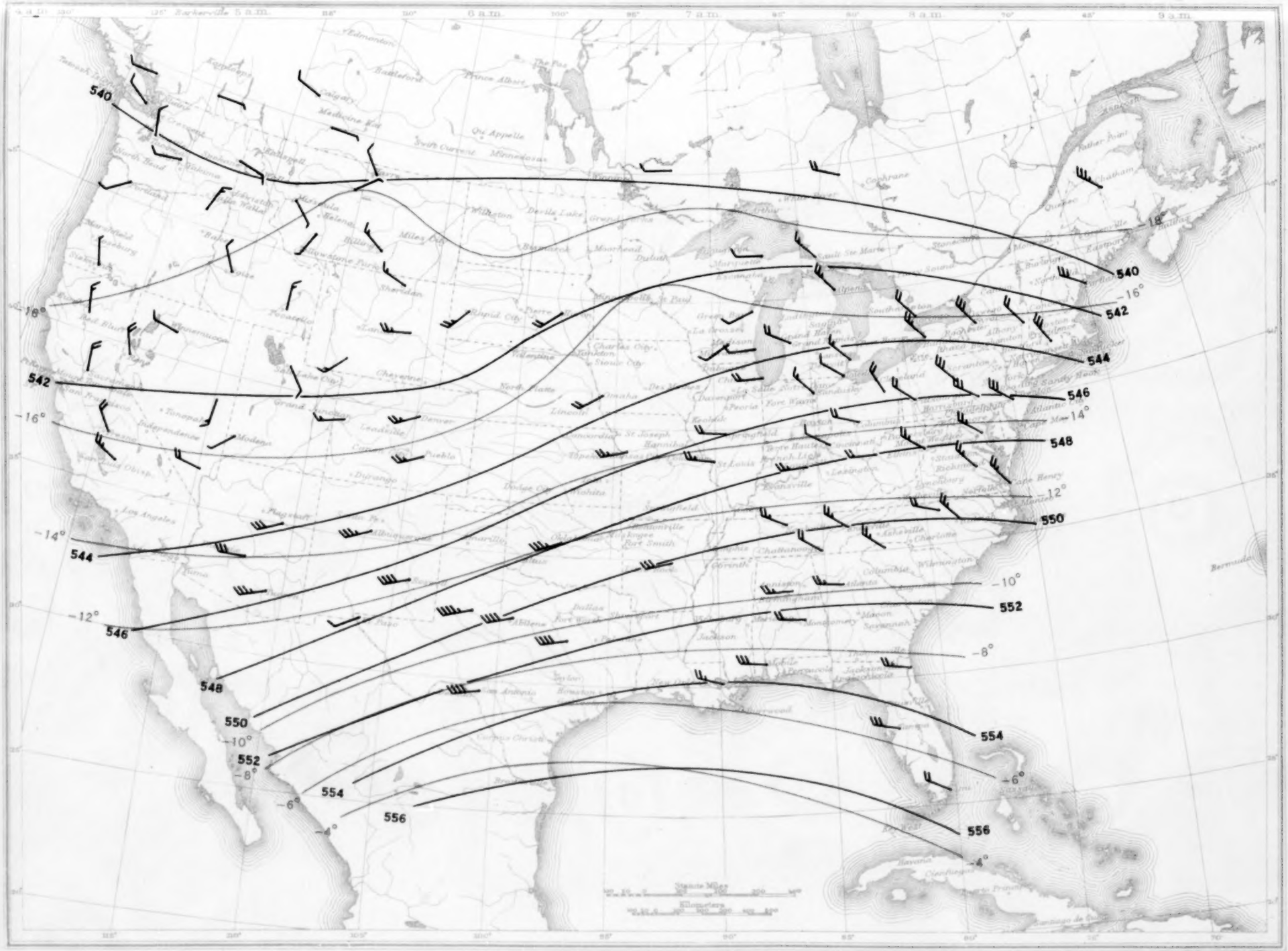
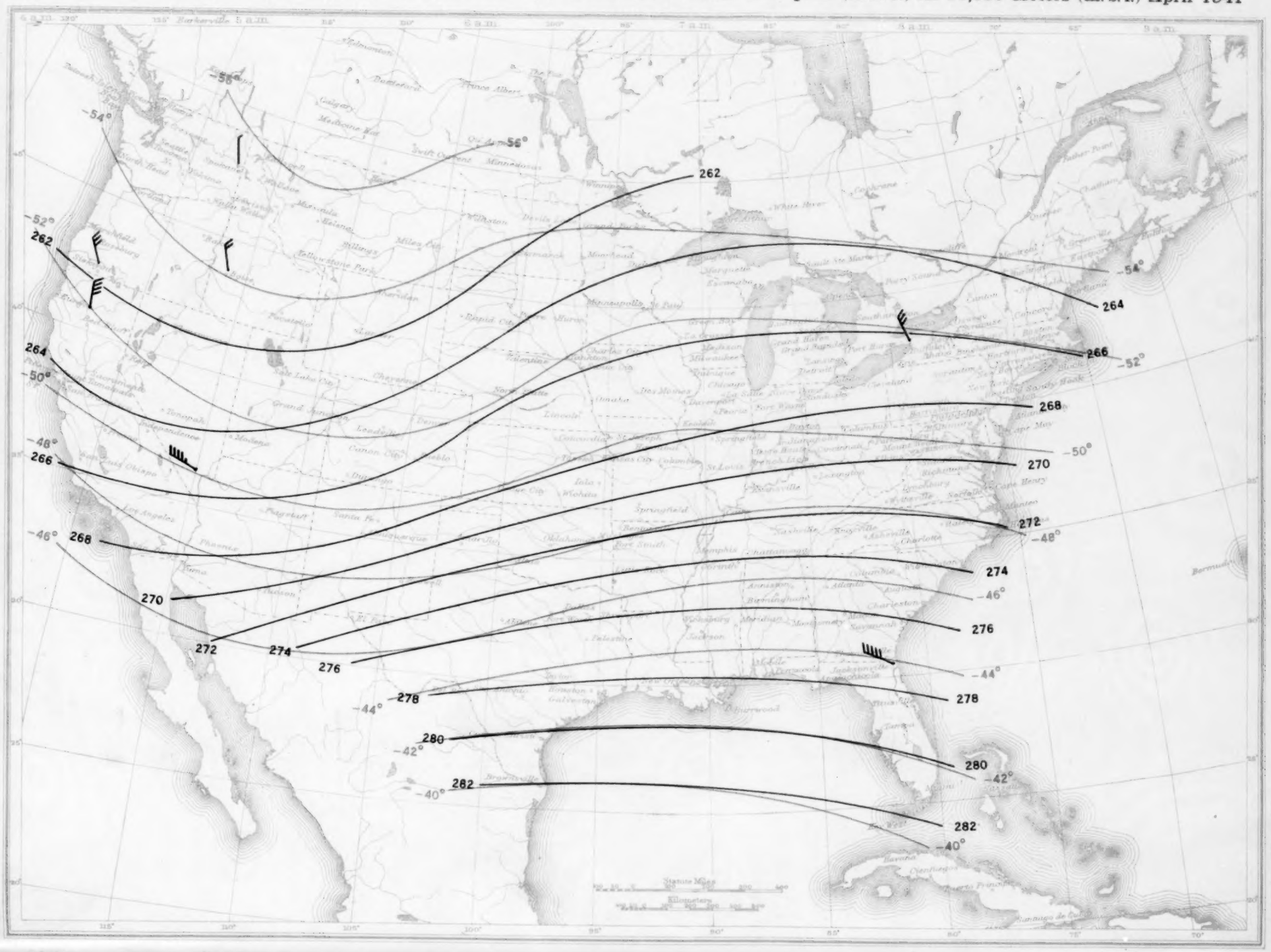


Chart XI. Isobars (mb) Isotherms (°C.) 1:00 a.m. (E.S.T.) and Resultant Winds 5:00 p.m. (E.S.T.) for 10,000 Meters (m.s.l.) April 1941



MONTHLY WEATHER REVIEW

Editor, EDGAR W. WOOLARD

VOL. 70, No. 1
W. B. No. 1348

JANUARY 1942

CLOSED MAR. 3, 1942
ISSUED 1942

ON A HYPOTHESIS CONCERNING THE NORMAL DEVELOPMENT AND DISINTEGRATION OF TROPICAL HURRICANES*

By W. F. McDONALD

[U. S. Weather Bureau, Washington, D. C., Nov. 1941]

Facts of observation on the origin of tropical cyclones are quite meager, although increasing at a steady rate. These storms begin most commonly in marine tropical regions, remote from areas covered by a network of meteorological land stations. Ships' observations are inadequate to give more than inconclusive hints as to the physical processes that attend the origin and development of the hurricane. The data from fully-developed hurricanes are much more complete, because mature storms often travel into regions where observations from ships and shore stations are numerous. Much still remains to be learned regarding the mechanism of mature cyclones, whether of tropical or extratropical origin, especially regarding the processes that are particularly important in forecasting; but origins are even more obscure.

In attempting to utilize the relatively meager body of knowledge regarding the inception and development of tropical cyclones, it may be helpful to formulate tentative working hypotheses, and examine to what extent they serve to connect the observations into logical relationship, with a minimum of exceptions. The present paper is an effort of this kind.

Let us first review some of the commonly accepted facts regarding normal tropical cyclones:

1. Tropical cyclones usually develop in regions where large masses of relatively homogeneous tropical marine air are normally in steady motion, as trade or monsoon winds.

2. The inception of a tropical cyclone is commonly associated with some conflict or disturbance in the normal wind stream of the locality.

3. The diameter of tropical cyclones is usually less at the beginning than at later stages of development.

4. The weight of available evidence indicates that as long as the cyclone remains within the Tropics and does not encounter a marked discontinuity, the barometric minimum for the particular storm does not deepen materially after 2 or 3 days from the time when true vortical character has been established. In other words, the normal increase in diameter of the cyclone with passage of time is usually not attended by a corresponding increase in depth of barometric minimum.

5. Tropical cyclones seldom, if ever, decrease in diameter with passage of time, once the vortex is established, and this is true even of the rare storm that moves from higher to lower latitudes.

6. Tropical disturbances usually decrease in intensity and disappear by rise of barometer at the center, without material contraction in the diameters of the closed isobars.

These several statements will fall into logical connection if there is a cycle of development, growth, and degeneration of the kind to be described in the remainder of this paper; the assumption is made that the normal life history of the cyclone is free from encounter with bold topographic barriers or heterogeneous air masses.

Given relatively uniform thermodynamic and kinematic characteristics over a large-scale atmospheric region in which a hurricane develops and travels, it would seem logical to expect such general factors to fix a limit to the intensity of the disturbance, once it is started.

Such conditions do, in general, characterize the regions from latitude 30° N. to 30° S., in which tropical cyclones most generally originate and maintain their distinctive character. It is hardly open to question that there is an extreme limit to the intensity of the hurricane-type storm; no central barometer reading lower than 26 inches has yet been recorded in a tropical cyclone. The variation from storm to storm above this limit is wide but there is considerable evidence pointing to the probability that the barometric intensity of any given disturbance has become established within a few days after the vortex originates.

Millas [1] concludes that the whole period of vortical development in West Indian hurricanes, from first causative action to full intensity, is of the order of about 8 days on the average. In a short note on a group of low barometer readings reported in 1933 from ships involved in West Indian disturbances, the present writer made the following remark:[2]

> The five readings below 28 inches were obtained in four separate storms. Furthermore, the lowest reading in each of these storms was observed within 1 or 2 days after the time at which the disturbance was definitely located in our reports, and no lower readings thereafter have as yet come to light, although in all cases these storms appear to have increased in extent and destructive power as they passed onward to later stages of development. This group of records therefore supports the view that tropical disturbances, often, or perhaps commonly, arise as intense vortices of small diameter, which expand in area and decrease in intensity as they progress.

The record minimum barometer actually observed in a cyclonic vortex at sea level was on the Dutch S. S. *Sapoeraea*, at the center of a typhoon in the Pacific about 460 miles east of Luzon.[3] This reading, 26.185 inches, was taken at a location so situated with reference to the region of most common origin of typhoons, as to lend support to the assumption that in this case also the storm may very probably have been only a few days old at the time of the observation.

A new record was established for the minimum barometer reading observed at sea level in the Western Hemisphere, when, after careful investigation, the Weather Bureau accepted a pressure of 26.35 inches as the official

*Modification of a paper presented before the American Meteorological Society, Miami, Fla., May 9, 1941.

[1] J. C. Millas. Genesis of Hurricanes of the Western Caribbean Sea. Reported in *Bulletin A. M. S.*, vol. 22, p. 78.

[2] McDonald, W. F. Low Barometer Readings in West Indian Disturbances of 1932 and 1933. MONTHLY WEATHER REVIEW, vol. 61, p. 273.

[3] *Meteorological Magazine* (London), February, 1933, p. 18, quoting *Nature*, (London) issue of August 18, 1928, p. 251.

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record in the Florida Keys storm of September 2, 1935.[4] This unusual pressure minimum and its attendant intense hurricane winds occurred within a storm diameter of about 50 miles, not more than 3 days after the initial cyclonic development near Turks Island. Data on this storm indicate that the vortex was constantly deepening during those 3 days. Pressure at the center began to rise as the disturbance passed beyond the Florida Keys; at the same time, the diameter of the area of hurricane winds increased. All of these developments took place during a period in which the cyclone moved over water surfaces broken only by small island areas; and the changes in the storm seem to have resulted from the progressive operation of causes inherent in the mechanism of the cyclone, rather than from any external influence.

The American S. S. *Virginia*, on September 20, 1933; passed through the center of a hurricane in the western Caribbean. The existence of this storm had not previously been recognized although an incipient condition had been noted during the 4 days preceding. This ship experienced a barometer of 27.44 inches, with a pressure fall of more than 2 inches within an hour and a half after entering the storm. It is estimated that this vortex was not more than 40 miles across at the time but was increasing rapidly in diameter.

The tropical hurricanes that have occasionally formed in the Gulf of Mexico and moved northward, to pass within 2 or 3 days across the middle Gulf Coast, have usually been of small diameter, with extraordinary violence near the center. Vortices that have crossed Puerto Rico have more often than not been of similar character, and examination of our charts of hurricane tracks will show that the region of origin of many of these Puerto Rican storms is not far east of the island.

From such evidence it seems logical to suppose that the preexisting thermodynamic state of the tropical air mass provides an environment in which intense local activity may occur, but *which at the same time predetermines a limit of intensity beyond which the action cannot go.*

Atmospheric soundings reported from several places in the Tropics afford some interesting evidence on this point. The radiosonde records from Swan Island in August 1940, show a more or less constant presence of a deep air mass in which the lapse rate equalled or exceeded the moist adiabatic up to 7,000 meters and on some days very much beyond that level. Moisture content was quite high, hence tremendous amounts of energy were potentially available in a state of conditional instability. One or more barrier layers, with lapse rate somewhat less than the moist adiabatic, existed in each case, but these barriers were slight and could undoubtedly be broken by any unusually strong convectional impulse from the very moist surface air layer.

A single daily temperature curve (for Sept. 10, 1940) from Swan Island, and the *monthly* average lapse curves for August 1940, at Swan Island, and for September 1940, at St. Thomas, V. I., are shown on figure 1.

The St. Thomas record is included because it shows a very steep lapse (almost superadiabatic) in the average for the lowest 500 meters. The depth of this unusual layer varied from 230 to 944 meters in 25 out of 28 daily sounding records available for September 1940. This wide variability, and the character of the changes in depth of the superadiabatic layer from day to day (which showed a peculiar persistence or trend over several days) are evidence against one explanation that has been offered for this remarkable steepness of lapse rate near the surface, namely, that it is a combination of effects from strong surface heating of the airfield and of instrumental heating while the airplane was being made ready for the sounding flight. Further evidence for the actual common existence of an excessively steep lapse rate near the surface in the trade wind belt of the North Atlantic, comes from the records[5] of the *Meteor* expedition in 1927, examples of which are shown in figure 2. These soundings were made from the deck of a ship, and there could have been no land surface effect because the locations were hundreds of miles from shore, in the eastern part of the tropical North Atlantic and in the steady trade wind belt.

The problem of how such steep lapse rates can commonly exist in air heavily charged with moisture has not been completely solved.[6] The observations cited above are from the trade-wind belt, where there is the fullest development of a large-scale steady state of the general wind stream in a relatively stable barometric field, and vorticity is at a minimum. Perhaps in such a field, the character of the wind stream at lower levels introduces what may be termed a factor of "kinematic or dynamic stability," which tends to suppress small perturbations of convectional nature so long as the broadscale flow pattern is maintained in a generally steady state; e. g., Brooks has remarked, concerning the island regions of the West Indies[7] "In midsummer, however, growth of the Bermuda-Azores HIGH, making stronger trades that tear convectional columns apart before they produce much rain, causes a distinct break in the warm season rainy period." Holzer, of the University of New Mexico, has reported similarly on the suppression of anticipated thunderstorm activity observed by him near Albuquerque when there was marked shear between the upper and lower strata involved in cumulus formations.

Any dynamic factor tending to counteract instability in trade wind or monsoon regions would weaken or disappear if the general wind stream should be appropriately disturbed, in which case the instability of the lowest layer might more readily lead to convectional overturning. Such overturning would tend to appear as local shower and squall conditions over the general area in which dynamic stability was weakened. Showers and squalls mark the "*preliminary*" phase of tropical cyclone origin.

Tropical storms usually begin as mild, but characteristically cyclonic, manifestations over an extensive area of warm ocean surface, several hundred miles in diameter. The normal course of the winds and weather suffers definite interruption; pressure falls slightly throughout the whole region of disturbance; the general drift of easterly winds is broken down, so that winds of southerly or even of westerly components appear; and numerous rain and thundersqualls are reported by ships that enter this region where the stage-setting for rapid cyclonic development is being slowly prepared.

The duration of the "*preliminary*" phase varies, but it commonly extends over several days, during which time there is likely to be a drift of the disturbed area in the direction in which the true vortex travels after it finally appears and moves away from the region of formation.

At the beginning there is neither a closed isobar as much as one-tenth of an inch below the surrounding field of

[4] McDonald, W. F. The hurricane of August 31 to September 6, 1935. Also lowest barometer reading in the Florida Keys storm of September 2, 1935. MONTHLY WEATHER REVIEW, 1935, 63:269–271; 295.

[5] Kuhlbrodt and Reger: Beilagen zu das Aerologische Beobachtungs-material. *Wissenschaftliche Ergebnisse der Deutschen Atlantischen Expedition "Meteor" 1925–27.* Berlin and Leipzig 1933.

[6] See, e. g., Sverre Petterssen: *Weather Analysis and Forecasting* (New York, 1940), p. 79.

[7] C. F. Brooks. Some North American connections of Caribbean climate. Reported in *Bulletin American Meteorological Society*, vol. 22, p. 79, 1941.

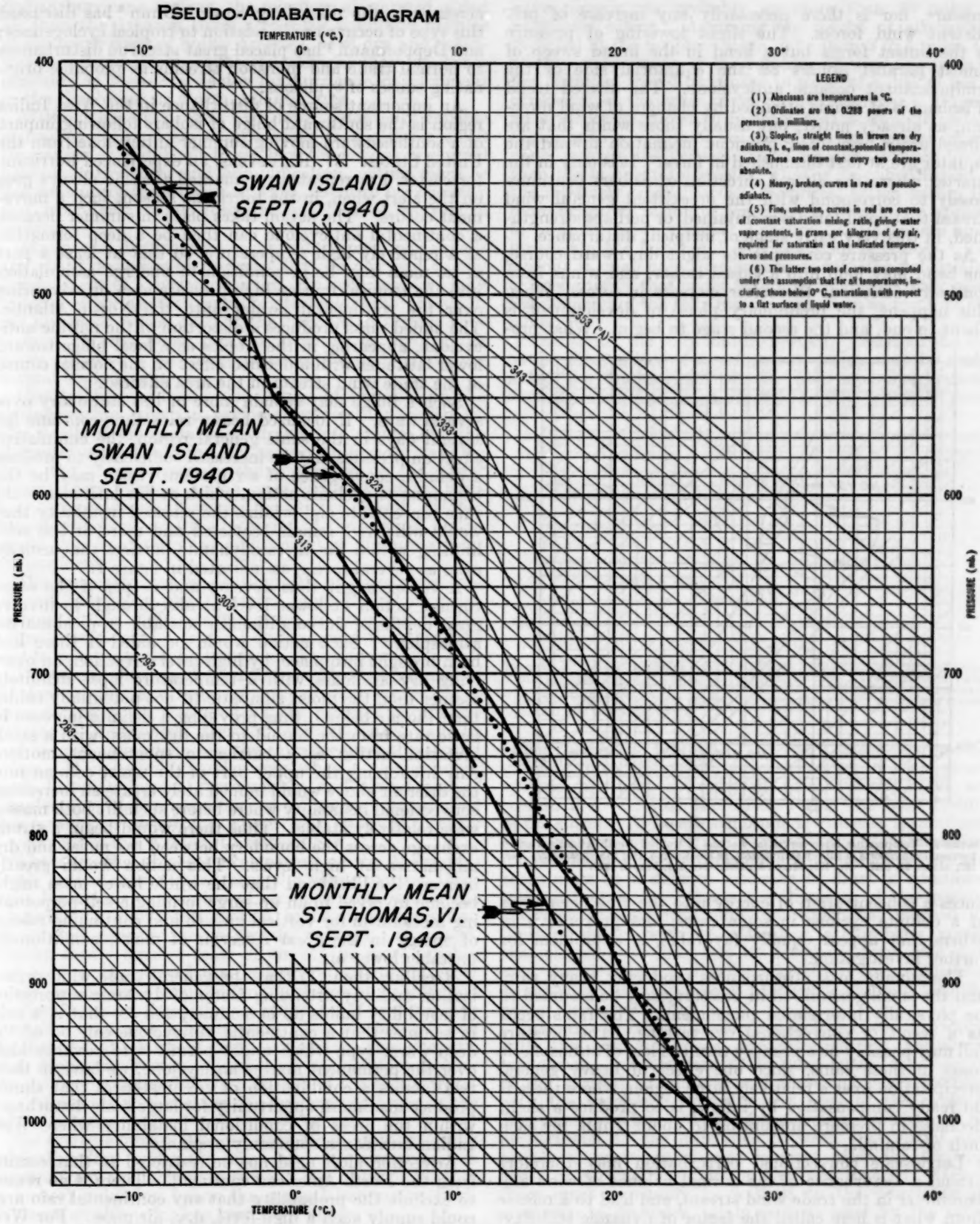

PSEUDO-ADIABATIC DIAGRAM
TEMPERATURE (°C.)
−10°
0°
10°
20°
30°
40°
400
500
600
700
800
900
1000
PRESSURE (mb.)
LEGEND
(1) Abscissas are temperatures in °C.
(2) Ordinates are the 0.288 powers of the pressures in millibars.
(3) Sloping, straight lines in brown are dry adiabats, i. e., lines of constant potential temperature. These are drawn for every two degrees absolute.
(4) Heavy, broken, curves in red are pseudo-adiabats.
(5) Fine, unbroken, curves in red are curves of constant saturation mixing ratio, giving water vapor contents, in grams per kilogram of dry air, required for saturation at the indicated temperatures and pressures.
(6) The latter two sets of curves are computed under the assumption that for all temperatures, including those below 0° C., saturation is with respect to a flat surface of liquid water.
SWAN ISLAND
SEPT.10,1940
MONTHLY MEAN
SWAN ISLAND
SEPT. 1940
MONTHLY MEAN
ST. THOMAS,VI.
SEPT. 1940
353 (A)
343
333
323
313
303
293
283

FIGURE 1.—Temperature lapse curves for Swan Island and St. Thomas, V. I., September 1940. Plotted with pseudo-adiabatic diagram.

pressure, nor is there necessarily any increase of preexistent wind forces. The slight lowering of pressure at the outset forms but a bend in the broad sweep of almost parallel isobars on the equatorial side of the semipermanent oceanic anticyclone. The altered trend of isobars is of course attended by changes of wind direction, as already noted; but usually those winds that are turned away from their previous inclination toward the Equator are at first diminished in force. It is only in the quarter where the altered direction of isobars continues closely to correspond with the preexistent general wind stream that wind force is maintained, or perhaps strengthened, in this very early stage of incipient disturbance.

As the pressure continues its slight downward course, the bend may loop into a closed isobar, and winds from southerly directions thereafter increase in force. When this happens, the preliminary phase of development is about to end, and the second stage to begin. What produces a concentration of energy into the true beginnings of a definite cyclone in some cases, and prevents it in others that appear equally favorable, is a problem for further investigation.

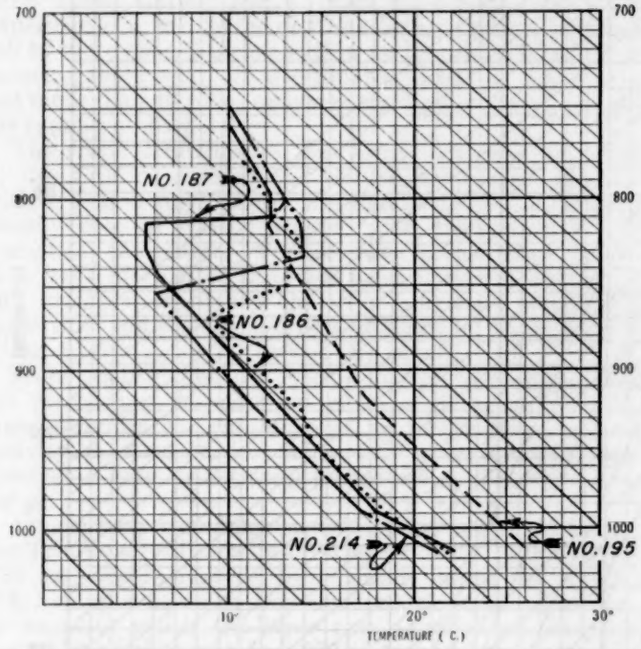


FIGURE 2.—Temperature lapse curves for stations in tropical North Atlantic, eastern portion; from reports of survey ship *Meteor*, as follows: No. 186; March 20, 1927. No. 187; March 21, 1927. No. 195; March 31, 1927. No. 214; May 8, 1927.

The squally local disturbances producing heavy rain, and the small general fall in pressure, may be assumed to be physically interrelated phenomena. The rains occur as a result of convectional overturning. The pressure fall may possibly be a primary result of loss of atmospheric mass in these rains, since one effect of heavy general precipitation over a relatively large region, where there is no ready compensation by inflow, is to produce a slight decrease in pressure amounting to about 2 mb. for each inch of rainfall.

Large-scale convectional perturbation may therefore attend a disturbance of the normal balance of wind and barometer in the trade wind stream, and lead to a release from what is here called the factor of dynamic stability. This causative action may appear as a progressive wave disturbance traveling westward through the trades; and the rain area and attendant fall in pressure would then accompany the disturbing wave. Dunn [8] has discussed this type of occurrence in relation to tropical cyclogenesis; and Deppermann [9] has placed great stress on disturbances to normal trade and monsoon streams as probable originating causes of typhoons.

An important source of disturbance in the West Indies region is the southward bulge of isobars following impact of a southeastward-moving summer anticyclone from the United States. W. R. Stevens, an experienced hurricane forecaster, has repeatedly remarked that he always goes on the alert when, in the hurricane season, such a movement occurs. The action takes place in summer because a continental anticyclone can then be a deep formation at a relatively high temperature, so that at least a part of its mass may be in condition to undergo assimilation into the tropical marine high-pressure area on advancing over the continental border onto the North Atlantic. The added mass produces a distortion of the marine anticyclone, appearing in the tropics as a local bulge toward lower latitudes with a decided effect on the normal course of the trade wind stream in the area affected.

Such a bulge may remain more or less stationary over several days. If localized heavy rains thus continue for several days in the same general region, the cumulative effect on pressure may be increased sufficiently to produce a definite convergence of air motion. Such may be the beginning of cyclonic action, which at low latitudes could thus concentrate and localize the released instability that would otherwise remain scattered and more or less self-limiting within the thermodynamic barriers that usually exist at several levels, as indicated in figure 1.

A vortex might thus develop and deepen if the overturning action at lower level breaks through to involve great depths of the conditionally unstable tropical marine atmosphere. Such action would be aided if there had been brought into place, by high-level advection, an overlying dry air mass with a temperature lapse definitely steeper than the moist adiabatic (if not potentially colder than the air below), thus providing a definite increase in lapse rate from the humid to the dry mass, with a small inversion acting as a barrier to spontaneous motion. Any lift forcing the upper part of the moist column into the drier air above would immediately create an increasing convectional instability where before such lift both masses were relatively stable. Thus there would begin a strong exchange across the boundary between the moist and dry air masses at high levels. This action would greatly increase the likelihood that the whole lower mass might become involved in an up-surge forming a self-perpetuating mechanism for vortical growth and continuing release of energy in the great reservoir of moist, conditionally unstable lower air.

Recalling then (1) that the general trade wind organization and any attending factor of dynamic suppression of instability builds up in summer, and (2) that it is only in summer that a continental anticyclone can be of the deep warm type which might permit it to advance aloft over the permanent marine anticyclone, we have in these two factors a combination of circumstances that should produce maximum opportunity for large-scale disturbance within the areas of conditional instability where West Indian hurricanes commonly originate.

Advection aloft need not be restricted to that coming from the North American continent. There is no reason to exclude the probability that any continental rain area could supply such a high-level, dry, air mass. For West

[8] G. E. Dunn. Cyclogenesis in the tropical Atlantic. *Bulletin American Meteorological Society*, vol. 21, pp. 215–229. June 1940.
[9] C. E. Deppermann. *Typhoons and depressions originating to the near east of the Philippines*. Manila 1940.

Indian hurricane regions, the overflow of warmed, dried air from the Amazon Basin across the mountain barriers of the north coast of South America, or of dry and potentially cool air from equatorial Africa, may at times provide the high-level factor for hurricane development in the Caribbean or North Atlantic area.

Without an air mass at high level potentially capable of leading to a release of instability in the lower moist air column, it is difficult to see how the actions of normal heating, turbulence, and humidification, acting more or less constantly from below upward, could so occasionally and irregularly break into the violence of a tropical cyclone.

Many local disturbances occur, with typical rain squalls and slight decreases in pressure, that do not lead to any development of a cyclonic vortex. In such cases we may suppose either that an appropriate factor was absent in the upper-air levels, or that the barriers to surface convection did not break down sufficiently to involve the whole air column, including an advection mass above the normal trade layer.

Clearly there can be a wide range of variation in the setting within which a cyclonic vortex may originate. The depth of the unstable air drawn into action, and the character of the superior air, are possibly more variable than the thermodynamic characteristics of the lower layers. Any vortical action once initiated would, however, progressively intensify until the whole column became involved, and the intensity of the vortical action would thus be determined and limited by the preexistent environment.

The preparatory slow development of large scale conditional instability plus the more rapid advent of a disturbing airflow aloft sets the stage, so to speak, for the actual inception of a tropical cyclone, and these may be said to constitute the first phase of the storm cycle.

The second phase is then initiated with the beginning of vortical motion, and lasts until the vortex reaches maximum intensity, as measured by the extreme barometric depression developed. Certain characteristics can be said to mark quite definitely the entrance upon this second phase. It is certainly under way when a closed isobar 3 mb. below its tropical surroundings, and a wind force of Beaufort 8 or higher, are observed. Tingley[10] has studied this second or deepening phase of a tropical cyclone developing in the Western Caribbean Sea.

Whatever the physical explanation of the thermodynamic action concentrated near the young vortex, there must be a positive eviction of air mass from within the intensifying field of rotary motion; by no other process can the central pressure be so greatly reduced. It is self-evident that a smaller mass of air can be more quickly and readily disposed of than a larger quantity; in other words, less power is required for an eviction of air sufficient to effect the same proportionate reduction of pressure over a smaller than over a larger area. This reasoning favors the theory that relatively small diameter is a characteristic of a deepening vortex. Formation at latitudes having low values for the deflective influence of the earth's rotation minimizes at this stage the tendency to broaden the field of rotation.

The extreme limit of pressure decrease in an intensifying tropical cyclone under the most favorable circumstances appears from available data to be of the order of 135 mb. (4 inches) reduction below the general barometric field. Evidence on this point has been cited above.

The smallest of the fully deepened vortices of which we have records are probably no more than 30 miles in horizontal extent. Assuming the height of atmosphere involved at the incipient stage to be from 2 to 5 miles, the relative proportions of the rotating atmospheric mass at first included would be similar to those of a disk of heavy cardboard of the order of an inch in diameter. There is no evidence whatever to indicate that a tropical cyclone begins with a vortex of the type of a waterspout or tornado, wherein the vertical axis of rotation is much longer than the horizontal diameter; what is described herein as the relatively small "focus" of vortical action within the more extensive region of preliminary disturbance appears to be from the very outset a section of atmosphere much broader in the horizontal direction than it is deep. The cyclone is small only by comparison with the potentiality of later growth, that under favorable conditions, may carry the diameter of the fully mature system to as much as 500 miles.

This term "the fully mature system," describes the end of the third phase of development, which may be designated the "*expanding*" phase. The expanding process normally continues much beyond the time when the deepening phase is finished. The very steep barometric gradient into the small, intense vortex of the young cyclone produces extremes of wind velocity that are seldom if ever found thereafter during the later history of the storm. Although atmospheric viscosity is small and the high symmetry of the vortical circulation minimizes its peripheral drag on surrounding, more quiescent air, there must be a definite tendency to draw in additional masses, that is, to increase the diameter of the system.

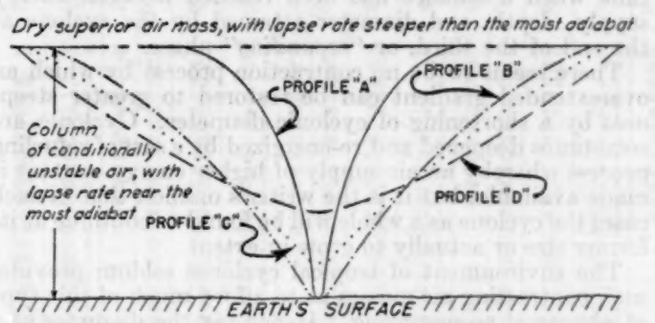

Dry superior air mass, with lapse rate steeper than the moist adiabat
PROFILE "A"
PROFILE "B"
Column of conditionally unstable air, with lapse rate near the moist adiabat
PROFILE "C"
PROFILE "D"
EARTH'S SURFACE

FIGURE 3.—Diagram illustrating vortical conditions (pressure profiles) representative of different stages in cycle of hurricane development and decay. Profile A, young vortex, at end of developing stage. B, fully mature, with gradient balanced by opposing influences. C and D, declining phases, with excess inflow of air, diminishing pressure gradient, and weakening vortex.

Giving a barometric minimum which has reached its limit of depth, with an attendant atmospheric vortex that continues to drag into its periphery, even at a slow rate, the air about it, the diameter of the vortex must increase while the steepness of barometric gradient into the center decreases. (Fig. 3.)

Internal and external resistances such as viscosity, friction with the earth's surface and internal and peripheral turbulence, are constantly drawing upon the energy of the vortical circulation; and these influences increase with the increasing diameter and area of the cyclone. The primary driving power of the system, which must be proportional to the difference between the central and peripheral pressures, cannot increase after the limiting depth of barometric minimum has been reached. Hence there must inevitably be a limit to the possibility of expansion in diameter, set in part at least by the same conditions that limited the deepening of the original vortex.

Latitude effects have been excluded from the reason-

[10] F. G. Tingley. The genesis of a tropical cyclone. MONTHLY WEATHER REVIEW vol. 39, pp. 340-347, 1911.

ing so far, and the discussion should be considered as applicable to a tropical cyclone moving along a parallel of latitude through a normal tropical marine environment. No mention has been made of the requirements or the mechanism for the continual supply of energy from inflowing warm moist air that is essential to sustain the normal development suggested; lack of a favorable environment would constitute one of the accidents that might distort the normal cycle at any point in its progress.

The effect, upon the circulation, of the increasing deflective influence that accompanies movement of a tropical cyclone to higher latitudes is, however, to be considered. This influence operates at all times toward an expansion of the diameter of the cyclone and it therefore belongs to the processes of the third phase; but it also continues to act in the last or *"declining"* phase. Deflection by the earth's rotation is a persistent influence working toward expansion of the area of a poleward-moving cyclonic system; and since many of the demands on storm energy come from resistances, as enumerated above, that depend directly upon area and circumference, the *"braking power"* of the deflective influence continues to operate beyond the time when a balance has been reached between energy supply, depth, and diameter attained by the cyclone at the end of the third, or *"expanding"* phase.

There seems to be no contraction process by which an overextended gradient can be restored to greater steepness by a shortening of cyclonic diameter. Cyclones are sometimes deepened and re-energized by a sort of refueling process whereby an air supply of higher energy content is made available; but it is the writer's opinion that in such cases the cyclone as a whole will be found to continue at its former size or actually to grow in extent.

The environment of tropical cyclones seldom provides such contrasting air masses as to afford much of this type of abnormal re-energizing. Hence, as the diameter of a tropical cyclone reaches the limit set by preexistent environmental factors, there can be but one further process of change, and the self-energizing ability of the system must diminish. The gradient will fail to maintain rotation at a rate that counteracts the tendency to an oversupply of inflowing air; the center begins to fill, and the barometric gradient thereafter suffers a rapid decrease; rotational velocities cannot be maintained and the whole system succumbs to friction and other disintegrating influences.

How often, if ever, tropical hurricanes actually complete, undisturbed, such a normal cycle of development and decline is impossible to estimate. Many, perhaps most of them, fail to do so. Distortion or interruption may occur at any stage whatever. If, however, there be this fairly regular progression of changes that characterizes the normal type, our recognition of this principle should enable us better to deal with the many abnormalities that undoubtedly occur and, furthermore, should aid us to anticipate what observational evidence to look for in order to locate hurricane disturbances at various stages of development.

For instance, there should be no expectation of finding exactly the same sort of sea disturbance in the vicinity of a small, very intense, young cyclone as will attend a mature hurricane of large diameter. In the earlier, more intense, phase the sea will of course be locally agitated with a violence greater than could be expected at the stage when the barometric gradient has become broader and less steep; but because the area of the young cyclone is small, the field of its influence shifts quickly to new and undisturbed sea areas, and the cumulative effects in the wave response (technically attributed to the "length of fetch" of the wind) are therefore of less importance than they are later when the area of the wind action is much larger.

It may, therefore, be anticipated that the swells from small, deep vortices will not differ much on opposite sides of the center of action. On the other hand, where large, mature storms are concerned, there would seem to be a much greater tendency for relatively long swells to run out ahead of the storm center. Such an expanded storm area, approaching over an open sea, can thus give the characteristic outrunning evidences in effects of swell and tide on shores in the line of its advance, as described by Cline,[11] but young (even though intense) storms, of small diameter, would show much less pronounced *advance* effects in swells and coastal tides, although the tidal effects may be very large as the center crosses a coastline.

Estimates of location and movement of tropical disturbances must oftentimes be based upon very meager observational material, not only as to the effects on the sea surface, but also as to meteorological observations. Where reports are few as is so often the case at sea, meteorologists inevitably show wide divergence of opinion in their interpretation of the inadequate evidence available. If it be accepted that characteristic differences distinguish phases in the cycle of hurricane development in some such manner as is herein suggested, there should at least be better agreement in such situations, and perhaps also practical benefits in hurricane forecasting.

To summarize, the writer's hypothesis attempts to bring into logical relation the general phenomena of tropical storms, as characterizing the process of a normal cycle of origin, development, and disintegration, recognizing four stages, as follows:

First.—The *"preliminary"* phase is represented as requiring a widespread condition of potential (convective) instability, in which vertical exchange is to a considerable degree suppressed by what is here called a "factor of kinetic stability," attributed to the action of the steady flow of the trade or monsoon wind stream; this condition occasionally breaks down to permit cyclogenesis by (*a*) distortion of the predominant wind stream (and its attendant barometric field) due to an advective "push" of a high-level air mass from a heated continental source, this distortion being attended by (*b*) increased convective overturning and concentration of heavy rainfall in the area subjected to greatest disturbance of the preexistent (balanced) wind stream. This action in turn permits the localization of vortical tendencies; and the further involvement of the central air column may finally extend to the level of any overlying advective air mass.

Second.—Once the whole air column is involved, the progressive localization and intensification of vortical action will proceed rapidly through the *"deepening"* phase, the limit to which is set by the thermodynamic characteristics of the environment; the young vortex expands at a relatively slow rate, and is usually at maximum intensity of gradient (and of wind velocity) at the end of the deepening phase.

Third.—The *"expanding"* phase is characterized by steady increase in the diameter of the cyclonic vortex through progressive involvement of peripheral air masses; but the pressure minimum remains about stationary, with a resultant lowering of the barometric gradient. Maturity with maximum development of total kinetic energy, is reached in this phase.

Fourth.—In the *"declining"* phase the processes of disintegration predominate because pressure gradient dimin-

[11] Cline, I. M. *Tropical Cyclones*, New York, 1926.

ishes beyond the point at which eviction of air equals or exceeds inflow to the vortex, an excess of air enters the system, the vortex fills and is destroyed.

The last three phases are to a considerable degree distinguishable only as separate maxima in effects of factors operating simultaneously throughout but at rates which distribute these maxima into different successive periods in a continuous process.

METEOROLOGICAL AND CLIMATOLOGICAL DATA FOR JANUARY 1942

[Climate and Crop Weather Division, J. B. KINCER in charge]

AEROLOGICAL OBSERVATIONS

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during January 1942*

Altitude (meters) m. s. l.	Stations with elevations in meters above sea level																							
	Albuquerque, N. Mex. (1620 m.)				Atlanta, Ga. (300 m.)				Bismarck, N. Dak. (505 m.)				Boise, Idaho (864 m.)				Brownsville, Tex. (6 m.)				Buffalo, N. Y. (221 m.)				Charleston, S. C. (14 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	841	3.1	42	31	985	3.8	71	31	958	−8.4	77	31	925	−5.8	89	31	1,022	12.5	88	30	989	−4.3	77	31	1,019	6.7	81
500	----	----	----	----	31	962	5.7	63	----	----	----	----	----	----	----	----	31	964	13.5	75	30	955	−5.0	83	31	960	8.5	66
1,000	----	----	----	----	31	905	4.6	59	31	900	−4.6	74	31	909	−4.2	87	31	908	11.7	70	30	896	−7.0	81	31	904	6.5	61
1,500	----	----	----	----	31	851	3.9	52	31	844	−5.5	69	31	854	−3.7	85	31	856	9.9	65	30	840	−8.4	77	31	851	4.8	55
2,000	31	803	3.4	42	31	800	3.1	44	31	791	−6.4	64	31	801	−2.5	79	31	805	8.7	57	30	787	−9.5	71	31	800	3.7	49
2,500	31	754	0.7	43	31	752	1.7	39	31	742	−8.6	62	31	752	−3.3	73	31	758	7.3	48	30	738	−11.1	68	31	752	1.7	42
3,000	31	709	−1.8	43	31	706	−0.6	36	31	695	−11.0	60	31	706	−5.1	70	31	713	5.6	43	30	691	−12.9	66	31	706	−0.6	38
4,000	31	624	−7.2	40	31	622	−6.6	35	31	610	−16.9	58	30	621	−10.3	64	31	630	−0.2	36	30	695	−18.1	63	31	622	−6.1	36
5,000	31	548	−12.8	38	31	547	−13.0	35	30	533	−23.3	57	30	544	−17.0	61	31	556	−6.5	33	30	528	−24.3	61	30	547	−12.9	36
6,000	31	480	−19.3	37	31	479	−19.6	35	29	464	−30.1	56	30	476	−23.6	57	30	488	−13.7	32	30	460	−31.3	60	28	479	−19.9	36
7,000	31	419	−26.5	36	31	418	−26.7	34	29	402	−37.2	55	30	414	−30.3	57	30	427	−21.0	32	30	398	−38.0	58	28	418	−26.9	35
8,000	31	364	−33.8	35	30	363	−34.1	33	29	347	−43.9	----	28	359	−37.4	57	28	373	−28.1	32	30	344	−44.5	----	26	363	−34.0	36
9,000	31	315	−41.0	----	30	314	−41.2	----	29	298	−49.6	----	27	310	−44.8	----	27	323	−35.3	33	29	295	−50.0	----	26	314	−40.9	----
10,000	30	272	−47.7	----	29	270	−47.8	----	29	256	−54.5	----	25	266	−51.6	----	27	280	−42.2	----	25	254	−54.0	----	26	270	−47.6	----
11,000	29	233	−53.5	----	29	232	−52.2	----	28	219	−56.9	----	24	228	−56.6	----	25	240	−49.7	----	25	217	−55.4	----	26	232	−52.4	----
12,000	29	199	−55.4	----	29	199	−54.7	----	24	186	−57.7	----	22	194	−58.5	----	23	206	−55.3	----	23	185	−54.0	----	23	199	−55.7	----
13,000	29	170	−56.0	----	28	170	−56.1	----	22	159	−56.8	----	18	166	−56.0	----	23	175	−61.0	----	22	158	−54.2	----	20	170	−57.2	----
14,000	28	145	−57.5	----	28	145	−57.5	----	18	135	−56.2	----	18	141	−55.1	----	22	149	−66.6	----	19	135	−55.0	----	19	144	−60.3	----
15,000	27	124	−59.5	----	25	124	−60.3	----	16	115	−57.4	----	16	120	−56.6	----	18	126	−71.7	----	18	116	−55.5	----	18	123	−63.2	----
16,000	25	106	−62.3	----	18	105	−63.0	----	13	98	−59.2	----	15	103	−58.2	----	15	107	−76.8	----	16	98	−56.3	----	16	104	−65.4	----
17,000	22	90	−63.8	----	11	89	−65.7	----	8	83	−59.7	----	14	88	−58.8	----	9	89	−79.4	----	7	84	−56.8	----	7	89	−67.2	----
18,000	15	76	−64.0	----	----	----	----	----	----	----	----	----	----	----	----	----	6	75	−80.1	----	----	----	----	----	----	----	----	----

Altitude (meters) m. s. l.	Denver, Colo. (1,616 m.)				Detroit, Mich. (194 m.)				El Paso, Tex. (1,193 m.)				Ely, Nev. (1,908 m.)				Great Falls, Mont. (1,128 m.)				Huntington, W. Va. (172 m.)				Joliet, Ill. (178 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	840	−4.9	72	31	993	−4.9	84	31	886	6.5	50	31	812	−5.7	84	30	890	−1.4	61	31	999	−1.5	77	29	996	−6.0	86
500	----	----	----	----	31	954	−5.3	83	----	----	----	----	----	----	----	----	----	----	----	----	31	959	−0.7	74	29	957	−5.9	85
1,000	----	----	----	----	31	896	−6.5	77	----	----	----	----	----	----	----	----	----	----	----	----	31	900	−2.8	72	29	897	−6.4	78
1,500	----	----	----	----	31	840	−6.7	69	31	854	8.8	47	----	----	----	----	30	849	0.1	57	31	845	−4.6	69	29	842	−6.4	71
2,000	31	800	−0.5	58	31	788	−7.7	63	31	803	6.3	46	31	803	−3.3	80	30	797	−2.7	54	31	792	−5.5	61	28	789	−7.4	67
2,500	31	751	−2.0	54	31	738	−9.5	63	31	756	4.0	45	31	754	−2.9	72	30	748	−5.5	53	31	744	−7.4	57	28	740	−9.1	65
3,000	31	706	−4.8	51	31	692	−11.8	62	31	710	1.7	42	31	708	−4.5	64	30	701	−8.5	52	31	697	−9.3	55	28	693	−11.4	62
4,000	31	620	−11.3	49	31	606	−17.0	62	31	627	−4.0	38	31	623	−9.7	61	30	616	−13.9	50	31	612	−14.5	54	28	607	−16.8	59
5,000	31	544	−17.8	48	31	530	−23.0	61	31	551	−10.5	36	31	546	−15.3	57	30	539	−20.8	48	31	536	−20.0	53	28	531	−22.8	61
6,000	31	475	−25.0	46	29	462	−29.4	56	30	483	−17.3	36	30	478	−21.9	56	29	470	−28.0	48	30	468	−26.5	53	28	462	−29.6	60
7,000	31	413	−32.0	45	28	400	−35.9	54	29	422	−24.4	35	29	416	−29.4	53	29	408	−35.3	47	28	406	−33.6	52	28	401	−36.6	58
8,000	31	357	−39.2	42	27	346	−42.6	----	29	367	−32.0	35	28	361	−36.9	52	29	353	−42.2	----	26	351	−41.2	----	28	346	−42.8	----
9,000	31	308	−46.2	----	26	298	−48.9	----	29	318	−39.8	35	27	312	−44.8	----	29	303	−48.9	----	24	302	−48.5	----	28	298	−48.2	----
10,000	30	265	−51.9	----	24	255	−52.2	----	28	274	−47.4	----	25	268	−52.1	----	28	260	−55.1	----	22	259	−53.3	----	27	255	−52.2	----
11,000	30	227	−55.6	----	21	219	−54.2	----	28	235	−54.0	----	25	229	−57.5	----	28	223	−59.1	----	20	222	−55.5	----	27	219	−54.2	----
12,000	30	194	−55.9	----	17	187	−53.3	----	28	201	−57.3	----	25	196	−58.6	----	28	190	−60.0	----	18	189	−55.9	----	27	187	−54.0	----
13,000	27	165	−55.5	----	15	160	−52.5	----	28	171	−58.7	----	21	167	−57.9	----	26	161	−58.0	----	14	160	−56.3	----	25	160	−53.4	----
14,000	26	141	−56.6	----	12	137	−51.5	----	26	146	−61.6	----	17	142	−58.8	----	23	138	−57.9	----	12	136	−57.9	----	24	137	−54.4	----
15,000	24	120	−58.7	----	10	117	−53.1	----	24	124	−64.4	----	12	122	−61.0	----	20	118	−59.6	----	7	116	−60.0	----	18	117	−55.7	----
16,000	21	102	−60.8	----	8	100	−54.4	----	24	105	−68.3	----	7	104	−63.8	----	13	100	−60.7	----	----	----	----	----	13	99	−57.4	----
17,000	14	87	−61.6	----	----	----	----	----	17	89	−71.1	----	----	----	----	----	5	85	−60.8	----	----	----	----	----	8	84	−58.5	----
18,000	6	74	−61.6	----	----	----	----	----	11	75	−71.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during January 1942*—Continued

Altitude (meters) m. s. l.	Lake Charles, La. (6 m.)				Lakehurst, N. J.[1] (39 m.)				Medford, Oreg. (401 m.)				Miami, Fla. (4 m.)				Nashville, Tenn. (180 m.)				Norfolk, Va.[1 2] (10 m.)				Oakland, Calif. (2 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	29	1,023	7.2	82	29	1,014	−2.9	68	31	971	4.7	82	31	1,020	15.1	87	31	1,000	0.6	71	20	1,021	2.8	73	31	1,020	9.7	84
500	29	963	8.9	63	29	957	−3.1	61	31	960	5.6	80	31	962	17.0	79	31	961	1.3	69	20	960	4.0	61	31	961	10.1	75
1,000	29	907	8.0	55	29	899	−4.7	56	31	903	5.6	70	31	908	13.9	80	31	903	−.1	64	20	903	2.6	56	31	905	8.8	68
1,500	29	854	7.3	48	29	843	−5.5	53	31	849	4.1	66	31	855	11.7	69	31	848	−.6	57	20	849	1.5	52	31	852	7.2	60
2,000	29	803	5.9	43	29	791	−6.4	48	31	798	1.7	65	31	805	9.8	61	31	796	−1.5	52	20	797	0.0	46	31	801	4.9	56
2,500	29	756	4.3	39	29	742	−7.8	45	31	750	−.7	63	31	758	7.4	53	31	748	−3.6	49	20	748	−1.8	38	31	753	2.2	53
3,000	29	710	2.1	36	29	695	−9.6	43	31	704	−3.4	59	31	713	5.3	47	31	702	−6.0	45	20	702	−3.7	35	31	708	−0.2	51
4,000	29	627	−3.4	35	29	610	−14.7	45	31	620	−9.2	52	30	631	.1	40	30	617	−10.6	42	20	618	−8.9	33	31	624	−5.6	45
5,000	28	552	−10.4	36	29	534	−20.7	47	30	544	−16.0	49	29	556	−5.9	37	29	541	−16.2	42	17	543	−16.2	30	31	548	−12.2	42
6,000	28	483	−17.6	37	28	466	−27.0	47	29	475	−23.3	47	27	488	−12.7	33	28	473	−22.9	40					31	480	−19.2	41
7,000	28	422	−24.8	37	28	404	−33.6	46	28	414	−30.7	46	27	428	−19.8	32	25	411	−30.2	39					30	419	−26.6	40
8,000	28	367	−32.4	36	27	350	−40.7	----	28	358	−38.4	46	27	373	−26.6	32	22	356	−38.1	38					29	364	−34.3	40
9,000	28	318	−40.0	36	26	301	−47.3	----	28	309	−45.7	----	26	324	−33.5	31	21	308	−45.1	----					28	315	−41.7	----
10,000	27	274	−47.0	----	25	259	−51.7	----	28	266	−52.9	----	26	281	−40.6	----	20	264	−50.6	----					25	271	−48.8	----
11,000	26	235	−52.8	----	25	223	−53.8	----	26	227	−58.7	----	26	242	−47.2	----	18	226	54.0	----					23	233	−54.6	----
12,000	22	201	−57.0	----	24	191	−54.0	----	24	194	−59.7	----	26	207	−53.4	----	17	193	−56.1	----					23	199	−57.3	----
13,000	22	171	−60.7	----	22	164	−54.5	----	21	165	−58.1	----	26	177	−58.5	----	16	164	−56.2	----					20	169	−57.9	----
14,000	21	146	−63.3	----	19	140	−55.2	----	19	141	−59.0	----	26	151	−63.3	----	11	140	−57.9	----					19	144	−57.4	----
15,000	20	124	−66.2	----	14	120	−56.1	----	18	120	−60.4	----	26	128	−67.7	----	10	119	−59.7	----					16	123	−59.6	----
16,000	16	105	−69.5	----	8	102	−57.2	----	15	102	−61.8	----	24	108	−70.9	----	8	101	−62.1	----					14	104	−61.3	----
17,000	10	88	−71.5	----	6	87	−58.4	----	11	87	−62.7	----	19	92	−73.0	----	5	85	−62.9	----					10	88	−63.0	----
18,000									5	73	−62.4	----	10	76	−73.5	----									8	75	−64.0	----

Altitude (meters) m. s. l.	Oklahoma City, Okla. (391 m.)				Omaha, Nebr. (301 m.)				Pensacola, Fla.[1] (24 m.)				Phoenix, Ariz. (339 m.)				Portland, Maine (20 m.)				St. Louis, Mo. (171 m.)				St. Paul, Minn. (225 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	30	977	1.0	68	31	985	−4.6	83	17	1,019	11.0	71	31	978	10.0	66	31	1,013	−6.7	71	31	1,000	−1.4	68	31	990	−6.6	78
500	30	964	2.5	66	31	960	−2.7	74	17	962	9.6	55	31	960	14.8	47	31	953	−6.9	74	31	960	−1.1	66	31	956	−6.7	78
1,000	30	906	2.7	61	31	901	−2.7	62	17	906	8.6	45	31	905	13.1	39	31	894	−8.3	71	31	902	−2.3	63	31	896	−7.6	75
1,500	30	852	1.7	59	31	846	−3.1	56	17	853	7.6	37	31	852	10.0	38	31	837	−9.7	69	31	846	−2.8	56	31	841	−7.7	57
2,000	30	800	1.0	51	31	794	−4.1	50	17	802	5.7	29	31	802	7.2	39	31	785	−11.0	69	31	794	−3.4	50	31	788	−8.8	63
2,500	30	752	−1.0	48	31	746	−6.3	48	17	754	3.4	29	31	755	4.4	37	31	735	−12.9	71	31	746	−5.5	48	31	739	−10.1	60
3,000	30	706	−3.3	45	31	699	−8.9	47	17	708	0.7	27	31	709	1.9	35	31	688	−14.8	70	31	699	−8.1	47	31	692	−12.3	58
4,000	29	621	−9.7	42	31	614	−14.0	45	17	625	−5.5	31	31	626	−3.5	35	31	602	−19.3	68	30	614	−13.3	48	31	606	−17.6	55
5,000	28	546	−15.9	42	30	537	−20.6	44	16	549	−11.7	30	31	551	−9.7	35	30	526	−25.1	66	30	538	−19.3	45	31	530	−24.1	54
6,000	28	477	−22.1	43	27	468	−28.2	43	16	481	−18.6	34	31	483	−16.7	35	30	457	−31.5	65	30	470	−26.1	44	31	461	−30.4	53
7,000	26	416	−29.3	42	27	406	−35.3	44	15	420	−25.8	36	31	422	−24.1	36	30	394	−38.2	63	30	408	−33.0	44	31	400	−37.6	52
8,000	26	360	−37.1	41	26	351	−42.1	----	7	364	−32.5	----	30	367	−31.7	36	30	342	−44.4	----	29	353	−40.0	----	30	345	−44.9	----
9,000	25	311	−44.5	----	26	302	−48.8	----	5	315	−39.5	----	30	318	−39.3	36	29	294	−49.5	----	29	304	−46.1	----	30	296	−50.9	----
10,000	25	268	−50.8	----	26	259	−54.2	----					29	274	−46.7	----	28	252	−52.7	----	28	262	−51.6	----	28	254	−55.1	----
11,000	23	230	−55.1	----	26	221	−56.7	----					29	236	−52.8	----	25	216	−53.2	----	28	224	−55.0	----	28	217	−56.8	----
12,000	22	196	−56.9	----	24	188	−56.7	----					29	201	−56.4	----	22	185	−53.0	----	27	191	−55.2	----	24	185	−56.1	----
13,000	21	168	−57.2	----	22	161	−56.0	----					29	172	−57.1	----	20	157	−52.9	----	22	163	−55.0	----	20	158	−54.3	----
14,000	16	143	−58.3	----	19	137	−56.1	----					28	147	−58.1	----	12	135	−54.0	----	20	139	−56.0	----	16	135	−54.6	----
15,000	11	121	−60.9	----	14	116	−58.2	----					27	125	−60.5	----	8	115	−55.2	----	17	118	−57.3	----	11	115	−57.0	----
16,000	9	104	−63.4	----	8	99	−59.4	----					25	106	−63.2	----	5	97	−55.0	----	15	100	−58.7	----	6	98	−58.5	----
17,000													17	90	−65.6	----					11	85	−59.9	----				
18,000													14	76	−66.2	----												
19,000													9	64	−65.3	----												
20,000													6	54	−63.9	----												

See footnotes at end of table.

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during January 1942*—Continued

Altitude (meters) m. s. l.	San Antonio, Tex. (174 m.)				San Diego, Calif.[1] (19 m.)				Sault Sainte Marie, Mich. (221 m.)				Seattle, Wash.[1] (27 m.)				Spokane, Wash. (598 m.)				Washington, D. C. (25 m.)				Anchorage, Alaska (42 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	1,003	8.9	64	30	1,016	13.3	81	31	987	−9.7	85	30	1,019	3.1	80	31	953	−5.0	93	31	1,016	0.9	68	31	998	−4.0	86
500	31	965	10.1	61	30	960	13.3	55	31	952	−10.5	87	30	962	4.8	68					31	958	−0.5	67	31	942	−1.0	71
1,000	31	908	8.9	62	30	905	11.5	41	31	892	−11.3	87	30	905	3.1	64	31	906	−4.2	87	31	900	−2.4	66	31	884	−2.2	66
1,500	31	855	7.9	58	30	852	8.9	34	31	836	−11.7	82	30	850	0.9	61	31	851	−3.8	80	31	844	−4.4	67	31	830	−4.9	67
2,000	31	805	6.6	53	30	802	6.7	29	31	782	−13.1	78	30	799	−0.6	55	31	798	−4.0	73	31	793	−5.2	63	31	778	−8.0	69
2,500	31	757	5.3	45	30	754	4.2	30	31	732	−15.3	77	30	750	−3.0	50	30	749	−5.5	67	30	744	−6.8	59	31	730	−11.1	70
3,000	31	712	2.7	40	30	709	1.4	30	31	685	−17.5	75	30	704	−5.6	51	29	702	−7.5	62	29	697	−8.4	56	31	683	−13.9	67
4,000	30	628	−2.7	32	30	625	−4.6	24	29	599	−22.5	69	30	619	−11.4	56	29	616	−13.1	58	29	612	−13.1	54	31	598	−20.2	65
5,000	30	553	−9.3	32	29	550	−11.2	33	28	522	−28.5	66	30	542	−17.3	54	28	540	−19.5	56	29	536	−19.2	56	31	522	−27.0	65
6,000	30	485	−16.5	31	29	482	−17.8	43	26	454	−34.8	63	30	474	−24.3	57	28	471	−25.9	54	28	468	−25.6	53	31	454	−33.6	64
7,000	29	424	−23.7	31	28	420	−25.6	47	26	392	−41.5	----	30	412	−31.8	59	28	409	−32.7	52	26	406	−32.6	52	31	392	−40.3	60
8,000	27	369	−31.2	30	13	366	−33.5	----	26	338	−47.8	----	29	357	−39.3	62	26	354	−40.2	----	25	352	−40.1	----	31	338	−46.1	----
9,000	25	320	−38.7	29	13	317	−41.1	----	24	290	−51.2	----	27	308	−47.2	----	26	305	−47.6	----	24	303	−47.4	----	31	291	−50.2	----
10,000	24	276	−45.1	----	8	273	−48.2	----	24	248	−53.1	----	25	264	−54.3	----	25	262	−54.2	----	23	260	−53.6	----	31	250	−52.3	----
11,000	22	237	−50.8	----	5	235	−54.2	----	21	213	−52.6	----	24	226	−59.4	----	25	224	−58.4	----	22	223	−56.3	----	29	214	−53.4	----
12,000	19	203	−54.5	----	----	----	----	----	17	182	−51.9	----	23	192	−62.0	----	23	191	−58.1	----	20	189	−56.7	----	29	183	−52.9	----
13,000	17	173	−57.1	----	----	----	----	----	14	156	−51.5	----	19	163	−60.0	----	21	163	−57.2	----	19	161	−56.9	----	29	157	−51.2	----
14,000	16	148	−60.2	----	----	----	----	----	11	133	−52.3	----	18	139	−59.2	----	17	139	−56.5	----	18	138	−57.6	----	27	134	−50.8	----
15,000	11	126	−63.0	----	----	----	----	----	7	114	−53.2	----	14	118	−59.6	----	14	118	−58.0	----	17	117	−59.3	----	24	115	−50.8	----
16,000	11	107	−66.2	----	----	----	----	----	6	97	−53.8	----	12	101	−60.2	----	10	101	−59.2	----	16	99	−61.3	----	14	98	−51.4	----
17,000	8	90	−68.0	----	----	----	----	----	----	----	----	----	7	86	−60.5	----	6	86	−60.2	----	10	84	−63.1	----	----	----	----	----
18,000	7	76	−69.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	6	71	−62.1	----	----	----	----	----

Altitude (meters) m. s. l.	Fairbanks, Alaska (156 m.)				Juneau, Alaska (49 m.)				Ketchikan, Alaska (26 m.)				Nome, Alaska (14 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	988	−13.6	88	31	1,004	3.4	84	27	1,009	5.7	79	27	1,000	−7.5	74
500	31	945	−7.9	82	31	950	2.0	82	27	952	3.5	78	27	940	−6.2	75
1,000	31	887	−5.2	74	30	892	−0.5	82	27	895	0.5	78	27	882	−6.9	73
1,500	31	832	−6.0	69	29	838	−2.6	80	27	840	−1.6	77	27	827	−8.3	71
2,000	31	780	−8.1	66	28	786	−4.7	75	25	789	−4.1	76	27	775	−10.7	69
2,500	31	731	−11.1	64	26	738	−7.3	70	25	740	−6.3	73	27	726	−13.7	68
3,000	31	684	−14.2	63	24	691	−10.2	65	24	694	−9.2	71	27	679	−16.7	67
4,000	30	599	−20.4	61	22	606	−16.3	60	22	608	−15.0	70	26	594	−23.3	65
5,000	30	522	−27.4	59	22	529	−22.5	58	22	532	−21.6	70	26	517	−29.6	64
6,000	30	454	−34.4	59	17	461	−29.8	55	18	464	−28.5	71	26	449	−36.1	63
7,000	29	392	−41.0	----	16	399	−37.0	56	18	402	−35.3	68	25	387	−42.4	----
8,000	29	338	−46.9	----	16	344	−44.3	----	16	347	−42.3	----	25	334	−48.1	----
9,000	28	290	−51.6	----	15	296	−50.9	----	16	298	−48.9	----	25	287	−51.7	----
10,000	28	248	−53.8	----	14	252	−56.2	----	16	255	−53.6	----	25	246	−51.7	----
11,000	27	213	−54.7	----	12	215	−59.1	----	16	218	−57.4	----	23	211	−50.9	----
12,000	26	182	−53.7	----	8	182	−61.0	----	14	186	−57.9	----	20	180	−49.0	----
13,000	26	155	−52.4	----	8	154	−59.2	----	10	158	−55.7	----	17	155	−47.2	----
14,000	21	133	−52.0	----	6	130	−57.4	----	9	135	−54.4	----	13	133	−46.5	----
15,000	15	114	−52.4	----	5	110	−57.5	----	7	115	−55.0	----	10	114	−46.7	----
16,000	10	97	−52.7	----	----	----	----	----	5	98	−55.8	----	5	98	−46.5	----

See footnotes at end of table.

LATE REPORTS

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during January 1942*—Continued

Altitude (meters) m. s. l.	Stations with elevations in meters above sea level.																							
	MAY				DECEMBER								YEAR 1941											
	Joliet,[3] Ill. (178 m.)				Fairbanks, Alaska. (156 m.)				Nome, Alaska (14 m.)				Anchorage, Alaska (41 m.)				Coco Solo, C. Z. (15 m.)				Fairbanks, Alaska (156 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	995	13.5	79	31	986	−18.5	78	31	997	−10.1	83	366	1,002	4.2	71	228	1,012	26.5	89	363	990	0.5	61
500	31	958	15.5	68	31	943	−13.7	77	31	937	−9.1	83	365	947	3.4	69	228	957	24.2	86	363	949	0.2	62
1,000	31	903	13.1	63	31	883	−11.5	74	31	878	−9.7	80	365	890	1.0	69	228	904	21.4	82	362	892	−1.6	63
1,500	31	850	10.3	61	31	827	−11.1	69	31	823	−11.7	77	363	836	−2.2	71	228	853	18.5	76	362	837	−3.7	64
2,000	31	800	7.5	60	31	775	−13.5	67	31	771	−14.4	73	362	785	−5.5	73	227	804	15.9	69	362	785	−6.4	66
2,500	31	753	4.6	60	31	725	−16.2	66	31	721	−17.1	68	360	736	−8.5	73	223	758	13.6	57	362	736	−9.4	66
3,000	31	708	1.4	61	31	678	−19.2	63	31	674	−20.4	66	357	690	−11.5	72	215	714	11.1	46	362	690	−12.5	66
4,000	30	625	−4.0	54	31	592	−25.5	62	30	588	−26.9	64	353	604	−17.6	69	130	633	4.4	45	360	604	−18.8	63
5,000	30	550	−10.4	49	30	515	−32.0	60	28	511	−33.4	63	342	528	−24.2	66					353	528	−25.3	60
6,000	29	482	−17.2	48	28	446	−38.9	59	28	442	−40.0	62	335	460	−30.9	64					350	459	−32.2	58
7,000	29	421	−24.0	47	27	385	−45.6	----	28	382	−46.0	----	332	398	−37.7	57					342	397	−39.0	----
8,000	29	366	−31.3	44	22	330	−51.6	----	27	327	−51.3	----	329	344	−44.2	----					326	343	−45.4	----
9,000	28	317	−38.6	----	20	283	−56.4	----	22	280	−54.7	----	323	296	−49.3	----					312	294	−50.5	----
10,000	28	274	−45.5	----	19	241	−58.8	----	21	240	−55.5	----	314	254	−51.2	----					305	252	−52.8	----
11,000	27	235	−51.6	----	16	206	−58.7	----	18	206	−53.7	----	307	218	−51.0	----					291	217	−51.9	----
12,000	25	201	−56.4	----	13	175	−57.5	----	13	175	−52.2	----	301	187	−49.6	----					278	185	−50.1	----
13,000	25	172	−59.5	----	10	150	−56.3	----	10	151	−51.5	----	283	160	−48.7	----					263	159	−49.2	----
14,000	25	146	−60.1	----	8	128	−55.5	----	8	129	−51.0	----	272	138	−48.6	----					244	136	−48.9	----
15,000	24	124	−59.0	----	6	109	−55.5	----	5	111	−50.6	----	253	118	−48.7	----					216	117	−49.1	----
16,000	23	106	−59.1	----									217	102	−48.9	----					182	101	−48.6	----
17,000	20	90	−59.4	----									168	88	−48.8	----								
18,000	15	76	−58.7	----																				
19,000	9	64	−56.0	----																				

YEAR 1941

Altitude (meters) m. s. l.	Juneau, Alaska (49 m.)				Ketchikan, Alaska (260 m.)				Nome, Alaska (14 m.)				San Juan, P. R. (15 m.)				Swan Island, West Indies (10 m.)				St. Louis, Mo. (171 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	354	1,005	7.2	76	350	1,009	8.7	78	355	1,007	−0.3	76	323	1,014	24.7	87	365	1,012	26.2	82	352	997	12.4	75
500	354	951	4.8	76	350	953	6.6	79	354	948	−1.6	75	323	960	22.8	87	364	957	23.1	86	352	959	12.4	70
1,000	350	894	1.7	78	350	896	3.4	79	353	890	−3.3	74	323	906	19.8	84	364	904	20.2	82	351	903	10.2	69
1,500	342	840	−1.3	80	346	842	0.5	79	353	835	−5.3	71	323	855	16.9	81	364	853	17.6	75	350	850	8.1	68
2,000	334	789	−4.1	80	344	791	−2.3	76	353	783	−7.6	67	323	806	14.6	72	365	804	15.2	69	350	800	6.0	65
2,500	324	740	−6.8	78	342	742	−5.0	71	353	734	−10.3	65	323	759	12.5	61	365	758	12.9	63	348	752	3.7	61
3,000	311	694	−9.6	74	341	696	−7.8	67	353	688	−13.1	63	320	715	10.0	53	365	714	10.5	56	348	707	1.0	59
4,000	286	609	−15.6	68	335	612	−13.9	62	344	602	−19.1	58	319	634	4.7	46	361	633	5.4	49	343	624	−4.6	55
5,000	263	532	−22.0	64	318	535	−20.4	60	337	526	−25.4	55	313	560	−0.8	42	357	560	−0.1	45	338	549	−10.6	50
6,000	239	464	−28.6	61	307	467	−27.1	57	328	457	−32.3	53	311	494	−6.8	39	352	493	−6.2	43	335	481	−17.0	46
7,000	219	402	−35.6	----	287	405	−34.1	51	326	396	−38.9	----	307	434	−13.4	36	350	434	−12.5	41	328	420	−23.8	42
8,000	204	347	−42.4	----	264	350	−41.1	----	314	342	−45.0	----	297	380	−20.3	35	348	380	−19.3	40	315	366	−30.9	----
9,000	177	299	−48.3	----	249	302	−47.3	----	303	294	−49.5	----	296	330	−27.6	35	345	331	−26.3	38	308	317	−38.1	----
10,000	161	256	−52.0	----	232	259	−51.2	----	289	252	−51.2	----	289	287	−35.2	34	342	288	−33.7	37	296	274	−44.9	----
11,000	148	220	−52.5	----	219	222	−53.0	----	276	217	−50.6	----	279	248	−43.0	----	336	249	−41.6	----	286	235	−50.5	----
12,000	140	188	−50.8	----	204	190	−52.2	----	265	186	−49.3	----	270	214	−50.6	----	330	214	−49.4	----	277	202	−54.3	----
13,000	125	161	−49.2	----	194	163	−51.1	----	254	159	−48.3	----	260	183	−58.2	----	322	184	−57.4	----	267	172	−57.1	----
14,000	116	138	−49.2	----	166	139	−51.0	----	237	137	−48.0	----	255	156	−65.2	----	306	156	−65.3	----	254	147	−59.3	----
15,000	----	----	----	----	144	119	−51.1	----	224	118	−48.0	----	244	132	−71.2	----	299	132	−72.5	----	238	125	−61.1	----
16,000	----	----	----	----	106	103	−51.4	----	190	102	−47.8	----	233	111	−75.3	----	292	111	−77.9	----	220	106	−62.2	----
17,000	----	----	----	----	----	----	----	----	147	88	−47.9	----	221	93	−76.6	----	267	93	−80.2	----	180	91	−62.3	----
18,000	----	----	----	----	----	----	----	----	----	----	----	----	193	78	−74.1	----	231	78	−78.1	----	----	----	----	----
19,000	----	----	----	----	----	----	----	----	----	----	----	----	160	66	−69.6	----	162	66	−73.7	----	----	----	----	----

[1] Navy stations.
[2] Airplane observations.
[3] Observations made at 1:00 a. m., 75th meridian time.

NOTE.—All observations taken at 11 p. m. 75th meridian time, except at Lakehurst, N. J., where they were taken near 5 a. m. (75th meridian time), between Jan. 1 and 21, and near 11 p. m. (75th meridian time), during the remainder of the month, and at Norfolk, Va., and at Seattle, Wash., where they are taken about 6 a. m. e. s. t.

None of the means included in this table are based on less than 15 surface or 5 standard level observations.

Number of observations refers to pressure only, as temperature and humidity data are missing for some observations at certain levels, also, the humidity data are not used in daily observations when the temperature is below −40.0° C.

TABLE 2.—*Free-air resultant winds based on pilot balloon observations made near 5 p.m. (75th meridian time) during January, 1942. Directions given in degrees from North (N=360°, E=90°, S=180°, W=270°)—Velocities in meters per second.*

Altitude (meters) m. s. l.	Abilene, Tex. (537 m.)			Albuquerque, N. Mex. (1,630 m.)			Atlanta, Ga. (299 m.)			Billings, Mont. (1,095 m.)			Bismarck, N. Dak. (512 m.)			Boise, Idaho (866 m.)			Brownsville, Tex. (7 m.)			Buffalo, N. Y. (220 m.)			Burlington, Vt. (132 m.)			Charleston S. C. (17 m.)			Chicago, Ill. (192 m.)			Cincinnati, Ohio (152 m.)			Denver, Colo. (1,627 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	31	280	1.5	31	269	1.5	30	282	3.1	30	241	5.6	31	294	5.5	25	112	1.4	26	75	1.8	28	238	4.7	30	186	1.3	30	287	1.2	27	267	4.2	31	238	2.4	30	219	0.8
500							30	279	4.0										26	95	3.0	28	242	8.2	30	219	3.7	30	255	3.0	27	268	5.9	31	242	4.4			
1,000	31	279	1.8				30	282	5.5				31	302	8.4	25	132	1.2	23	75	2.0	20	247	11.4	28	250	5.9	28	249	5.1	24	267	8.1	27	253	7.0			
1,500	28	257	4.0				28	278	8.9	30	267	9.7	29	310	12.2	25	152	1.4	22	272	1.6	12	270	9.0	22	267	9.6	28	259	8.7	22	273	10.8	23	279	9.6			
2,000	27	269	6.2	31	272	2.3	26	279	11.8	30	295	9.9	26	309	13.0	23	208	2.2	19	265	2.8				11	294	9.0	25	271	11.1	21	280	13.4	20	280	13.7	30	273	1.4
2,500	25	289	8.0	31	281	3.3	25	280	14.0	29	294	10.4	26	310	14.2	19	230	3.3	16	272	3.9							25	264	13.0	20	280	14.4	17	282	15.4	30	292	4.4
3,000	23	285	10.4	31	287	6.6	24	280	16.1	27	297	11.2	25	309	14.8	19	252	4.2	16	273	6.0							25	262	14.4	19	284	17.1	13	279	15.3	29	292	6.8
4,000	23	283	13.7	29	291	11.1	20	285	17.5	24	303	12.8	24	312	15.3	16	280	5.7	13	287	7.6							22	264	19.0	16	283	20.4				25	300	10.3
5,000	22	279	17.3	28	288	15.2	19	286	19.8	22	305	12.8	24	307	17.7	11	311	8.0	12	290	7.6							17	267	20.4	13	284	21.2				21	311	12.5
6,000	20	279	19.6	27	288	19.9	17	282	19.0	19	311	11.8	22	307	18.0				11	279	10.3							14	267	19.0							19	313	13.5
8,000	16	287	23.5	20	288	19.6							19	304	18.8				11	280	15.9																	
10,000	13	286	28.9	14	287	22.4							14	292	17.0																							
12,000				12	278	26.0							11	302	14.0																							

Altitude (meters) m. s. l.	El Paso, Tex. (1,196 m.)			Ely, Nev. (1,910 m.)			Grand Junction, Colo. (1,413 m.)			Greensboro, N. C. (271 m.)			Havre, Mont. (767 m.)			Jacksonville, Fla. (16 m.)			Las Vegas, Nev. (570 m.)			Little Rock, Ark. (88 m.)			Medford, Oreg. (410 m.)			Miami, Fla. (10 m.)			Minneapolis, Minn. (265 m.)			Mobile, Ala. (66 m.)			Nashville, Tenn. (194 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	31	221	0.8	31	349	0.5	30	112	0.5	29	278	1.9	31	255	4.0	31	281	1.6	31	54	2.6	31	304	1.2	29	97	0.5	31	16	1.8	31	277	3.1	30	309	1.9	29	267	1.8
500										29	273	3.3				31	261	3.6				31	285	2.7	29	143	.4	31	31	2.1	31	278	4.4	29	296	2.8	29	258	3.5
1,000										29	277	4.9	31	260	8.2	31	257	5.3	31	42	3.1	30	282	5.4	29	145	3.8	31	360	.9	24	299	7.9	27	300	4.2	25	266	4.4
1,500	31	242	.8							29	279	7.6	30	279	10.8	29	269	7.5	31	33	2.1	30	284	8.7	29	180	4.9	31	272	1.9	22	309	9.3	26	308	7.7	24	282	6.6
2,000	31	269	1.6	31	169	.2	30	39	.4	23	277	11.4	28	289	11.3	28	272	10.9	31	314	.5	28	282	10.5	29	204	6.0	29	276	4.9	21	308	12.2	26	298	8.9	22	288	10.1
2,500	30	272	5.3	31	209	1.4	30	246	1.2	21	282	13.2	26	288	12.1	26	272	11.3	31	297	1.7	27	287	12.4	24	210	5.5	27	265	5.6	20	309	13.6	22	286	8.5	21	287	13.4
3,000	28	272	8.8	31	260	1.5	30	253	3.7	20	285	16.0	23	291	11.7	26	270	12.0	31	276	3.2	24	289	13.2	20	199	3.6	22	269	7.8	20	308	14.9	21	288	10.8	18	287	15.3
4,000	28	278	12.2	26	295	4.4	24	298	5.9	18	286	20.6	21	300	12.8	25	269	15.9	31	277	6.6	20	289	15.5	16	200	3.0	21	265	10.2	18	306	18.3	18	276	14.1	11	289	18.7
5,000	27	282	15.0	21	307	6.8	22	309	7.7	16	282	21.5	16	293	11.4	24	269	17.8	26	303	9.3	16	294	16.3	16	243	3.4	19	264	11.6	17	311	20.4	12	283	12.0			
6,000	24	280	16.7	21	311	9.1	17	302	8.6	16	282	24.8	12	309	11.3	21	270	21.7	25	298	13.3				15	264	4.4	17	270	14.9	15	310	23.0						
8,000	20	289	17.4	17	323	16.7				11	285	24.9				13	272	23.3	21	299	18.8							12	274	23.2	11	306	26.3						
10,000	16	288	20.0	16	313	22.3													17	306	24.4																	
12,000	10	274	25.3	13	299	22.3													15	292	26.7																	
14,000																			10	280	22.5																	

Altitude (meters) m. s. l.	New York, N. Y. (15 m.)			Oakland, Calif. (8 m.)			Oklahoma City, Okla. (402 m.)			Omaha, Nebr. (306 m.)			Phoenix, Ariz. (338 m.)			Rapid City, S. Dak. (982 m.)			St. Louis, Mo. (181 m.)			San Antonio, Tex. (180 m.)			San Diego, Calif. (15 m.)			Sault St. Marie, Mich. (230 m.)			Seattle, Wash. (12 m.)			Spokane, Wash. (603 m.)			Washington, D. C. (24 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	28	288	4.1	28	264	0.4	30	301	1.9	30	291	3.2	31	98	0.2	31	334	5.7	30	264	3.7	31	30	0.5	30	299	2.8	24	316	1.0	26	146	1.4				30	272	1.9
500	28	272	6.5	28	107	1.8	30	290	1.9	29	295	4.4	31	93	0.5				30	266	5.7	31	26	0.9	30	310	1.3	24	273	2.3	26	142	4.2				30	251	4.2
1,000	26	274	8.9	25	169	1.2	30	282	3.3	28	302	7.8	31	102	1.3	31	332	5.7	28	277	8.0	30	254	0.9	29	34	0.2	19	294	4.7	23	159	4.1				28	261	7.5
1,500	24	285	11.1	24	201	2.1	29	286	6.6	28	302	10.2	31	116	1.3	31	315	9.1	26	289	10.3	26	272	2.6	29	315	1.2	12	325	7.3	23	188	4.3				28	273	10.1
2,000	17	289	13.9	17	211	1.6	28	288	7.8	28	304	11.7	31	251	0.5	30	311	10.8	26	290	12.3	23	268	4.5	29	310	2.4				20	199	5.8				26	275	13.2
2,500	16	286	15.2	14	3	0.8	26	282	9.0	28	302	13.1	31	276	2.5	29	313	12.1	26	294	13.5	22	270	6.0	27	296	4.1				20	206	6.5				22	279	16.6
3,000				14	318	1.7	25	286	11.2	28	301	13.5	30	289	4.3	29	311	13.2	24	296	16.0	21	272	8.9	25	294	4.5				17	212	5.2				20	280	19.9
4,000				12	302	7.8	24	289	13.2	24	302	15.3	29	286	6.6	28	309	14.8	22	294	18.3	18	276	12.6	22	279	6.4				13	237	6.8				15	280	26.4
5,000				11	312	10.3	22	293	16.2	22	296	17.1	25	296	9.9	27	313	15.6	19	295	21.5	17	278	14.1	19	283	9.0										14	283	30.5
6,000							16	295	16.3	22	299	18.5	23	290	13.2	24	313	15.6	17	299	21.1	16	281	16.7	15	281	9.3										10	291	35.0
8,000										13	313	20.0	17	303	17.1	20	322	18.1				11	294	21.1															
10,000													10	293	19.3	13	315	18.5																					
12,000																10	296	14.5																					

TABLE 3.—*Maximum free-air wind velocities (m. p. s.), for different sections of the United States based on pilot balloon observations during January 1942*

Section	Surface to 2,500 meters (m. s. l.)					Between 2,500 and 5,000 meters (m. s. l.)					Above 5,000 meters (m. s. l.)				
	Maximum velocity	Direction	Altitude (m.) m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m.) m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m.) m. s. l.	Date	Station
Northeast [1]	59.0	WSW	1,810	17	Binghamton, N. Y.	55.6	W WSW	3,700 5,000	7 10	Boston, Mass. Raleigh, N. C.	48.8	W W	7,310 7,130	28 6	Caribou, Maine Washington, D. C.
East-Central [2]	46.2	WNW	2,500	2	Raleigh, N. C.	61.0	W	4,700	2	Washington, D. C.	72.0	W	7,110	6	Greensboro, N. C.
Southeast [3]	40.2	WNW	1,910	8	Jacksonville, Fla.	40.9	WNW	5,000	8	Atlanta, Ga.	69.2	SW	11,320	11	Jacksonville, Fla.
North-Central [4]	56.7	NW	1,970	13	Rapid City, S. Dak.	46.2	NW	4,640	6	Bismarck, N. Dak.	72.0	NW	11,110	7	Huron, S. Dak.
Central [5]	43.2	WSW	2,370	13	Des Moines, Iowa	66.2	WNW	4,150	7	Wichita, Kans.	77.2	W	9,020	5	Wichita, Kans.
South-Central [6]	35.5	NW	2,500	9	Tulsa, Okla.	48.0	W	4,430	30	Houston, Tex.	78.0	WSW	17,140	24	San Antonio, Tex.
Northwest [7]	33.2	E	260	13	Tatoosh Island, Wash.	48.0	W	3,770	11	Butte, Mont.	72.0	NNW	10,430	29	Boise, Idaho.
West-Central [8]	35.4	NE	620	11	Oakland, Calif.	44.0	WNW	4,840	6	Cheyenne, Wyo.	70.0	NW	15,140	6	Ely, Nev.
Southwest [9]	32.8	SSE	2,040	21	Bakersfield, Calif.	46.0	WNW	4,530 4,710	3	El Paso, Tex	68.0	WNW	13,530	4	Winslow, Ariz.

[1] Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania and Northern Ohio.
[2] Delaware, Maryland, Virginia, West Virginia, Southern Ohio, Kentucky, Eastern Tennessee and North Carolina.
[3] South Carolina, Georgia, Florida and Alabama.
[4] Michigan, Wisconsin, Minnesota, North Dakota and South Dakota.
[5] Indiana, Illinois, Iowa, Nebraska, Kansas and Missouri.
[6] Mississippi, Arkansas, Louisiana, Oklahoma, Texas (except El Paso), and western Tennessee.
[7] Montana, Idaho, Washington and Oregon.
[8] Wyoming, Colorado, Utah, northern Nevada and northern California.
[9] Southern California, southern Nevada, Arizona, New Mexico, and extreme west Texas.

RIVER STAGES AND FLOODS

By BENNETT SWENSON

Widespread deficiencies of precipitation marked the month of January 1942. Every State except Florida had below normal precipitation; for the country as a whole, the weighted average precipitation was 1.55 inches, or two-thirds of normal. Floods were few and scattered; light to moderate floods occurring principally in portions of the Southeast and in the Sacramento Valley.

Atlantic Slope drainage.—Portions of the Altamaha River system were in flood at the beginning of the month as the result of heavy rains during the latter part of December. Additional moderate to heavy rains from January 2–4 served to augment the rises. Primary and secondary crests in the Ocmulgee River reached the Altamaha after the crest from the Oconee River, with resultant flood crests of considerable duration throughout the Altamaha, the river at Everett, Ga., being above flood stage from the 4th to the 19th. The total losses from the flooding during the period December 24 to January 19 has been estimated at $15,600.

Light flooding occurred in the Savannah River at Clyo, Ga., with a crest of 8.6 feet on January 4–5. No damage was reported.

Otherwise stages were generally low.

At the end of the month the snow cover was practically absent from the Delaware and Susquehanna River basins, except in the upper portions, southward. The only snow depths of consequence were in the extreme north portions of New York and New England.

East Gulf of Mexico drainage.—River stages had barely begun to subside after the heavy rains in the latter part of December when further heavy rains during the first few days of January caused a second rise in the streams. Flood stages were exceeded in the second rise in the Flint River at Albany, Ga., in the Apalachicola River at Blountstown, Fla., and in the Pearl River at Pearl River, La. Flood losses were slight; the losses in the Pearl River during the period of flooding from December 22 to January 11 was estimated at slightly less than $8,000.

Ohio River basin.—Stages were generally low throughout the month. In the Allegheny River an ice gorge formed at Parkers Landing, Pa., and held from January 21 to 25. The maximum stage reached at Parkers Landing was 13.5 feet. In the vicinity of Evansville, Ind., there was moderate to heavy ice in the Ohio River between January 6 and 15, resulting in some delay to boat traffic. Floating ice was observed at Cairo, Ill., from the 10th to the 15th.

Mississippi System (except Ohio River).—Ice in the lower Des Moines River broke up toward the close of January and an ice gorge formed in the vicinity of Chillicothe, Iowa, where considerable low land was flooded. At Ottumwa, Iowa, an estimated crest of about 10 feet was reached on the 27th.

In the Missouri River the stage of 1.3 feet at Omaha, Nebr., on January 1, 1942, is the lowest stage of record.

The Mississippi River was highest at the beginning of the month, falling during the first half and rising thereafter. Flood stage was not reached, however, except at Louisiana, Mo., due to the manipulation of Dam No. 24. Floating ice was observed in the main river from the 5th to the 14th in the reach from Cape Girardeau to New Madrid, Mo., and the upper reaches were frozen following severe cold during the first 10 days of the month.

Slight overflows occurred in the White River of Arkansas, in the St. Francis River basin at Manila, Ark., and in the Coldwater River at Coldwater, Miss., during the first half of the month. The North Canadian River at Yukon Okla., remained slightly above flood stage the entire month. No damages were reported from these overflows.

Pacific Slope drainage.—Moderate flooding occurred in the Sacramento River during the latter part of the month. The total damage from this overflow has been estimated at approximately $115,000.

The flood had its beginning on January 23, when moderate to heavy rains occurred in the morning in the upper Sacramento Valley. During the night of the 23–24th, heavy rains occurred again in the upper Sacramento and light rains in the Feather and American River basins. Heavy rains occurred in the American River basin on the 25th; elsewhere the rains were light or moderate but marked increases in temperature were favorable for snow melt in the higher mountains.

The morning of the 26th brought continued intermittent rain and high temperatures and during the night the passage of a cold front was accompanied by heavy rains over the entire Sacramento Valley. These rains caused a pronounced secondary rise in all of the streams.

At Red Bluff, Calif., the Sacramento River crested at 23.0 feet on the 25th, followed by a higher crest of 23.8 feet on the 27th. The overflow at Fremont Weir reached a peak of 3.9 feet on the 28th. The Sacramento Weir was opened on the 27th when a stage of 28.3 feet was reached at Sacramento. The river receded 0.2 foot following this, rose slightly again but did not reach the previous high stage.

Estimated flood losses and savings for January 1942

River and drainage	Tangible property	Matured crops	Prospective crops	Livestock and other movable farm equipment	Suspension of business	Total losses	Total savings
ATLANTIC SLOPE							
Altamaha River	$2,800	$800	$5,200	$3,400	$3,400	$15,600	$11,000
East Gulf of Mexico							
Pearl River					7,850	7,850	5,500
PACIFIC SLOPE							
Sacramento River	68,900	6,000	10,000	1,000	29,000	114,900	34,000

FLOOD-STAGE REPORT, JANUARY 1942

[All dates in January unless otherwise specified]

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
ATLANTIC SLOPE DRAINAGE					
	Feet			*Feet*	
Savannah: Clyo, Ga	11	(1)	15	15.8	4
Ogeechee Dover, Ga	7	(1)	16	8.6	4–5
Ocmulgee:					
Abbeville, Ga	11	(1)	10	13.4	2
Lumber City, Ga	15	6	6	15.1	6
Oconee: Mount Vernon, Ga	16	(1)	5	17.2	2
Altamaha:					
Charlotte, Ga	12	(1)	16	18.9	5
Everett City, Ga	10	4	19	12.4	9

See footnotes at end of table.

FLOOD-STAGE REPORT, JANUARY 1942—Continued

[All dates in January unless otherwise specified]

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
EAST GULF OF MEXICO DRAINAGE					
Flint: Albany, Ga	20	3	5	22.2	5
Apalachicola Blountstown, Fla	15	(1)	15	19.2	6–7
Pearl: Pearl River, La	12	(1)	11	14.4	7
MISSISSIPPI SYSTEM					
Upper Mississippi Basin					
Des Moines: Ottumwa, Iowa	9	27	27	[2] 10.0	27
Mississippi: Louisiana, Mo	12	9	24	[2] 12.2	24
		27	28	12.0	27–28
White Basin					
Black: Black Rock, Ariz	14	1	4	15.4	2
White:					
Georgetown, Ark	21	1	7	21.7	4
Clarendon, Ark	26	5	14	26.5	8–12
St. Charles, Ark	25	11	17	25.3	14
Red Basin					
Sulphur: Ringo Crossing, Tex	20	31	(4)	[2] 22.0	Feb. 1
Arkansas Basin					
North Canadian: Yukon, Okla	8	(1)	(4)	9.7	8
Lower Mississippi Basin					
Big Lake Outlet: Manila, Ark	10	5	10	10.3	8
Coldwater: Coldwater, Miss	13	1	6	14.0	3
PACIFIC SLOPE DRAINAGE					
San Joaquin Basin					
Mokelumne: Bensons Ferry, Calif	12	28	30	14.7	28
Sacramento Basin					
Sacramento:					
Red Bluff, Calif	23	25	25	23.0	25
		27	27	23.8	27
Knights Landing, Calif	30	27	(4)	31.5	28
Columbia Basin					
Long Tom: Monroe, Oreg	10	(1)	2	10.4	Dec. 31
		7	11	12.0	9
		14	21	11.1	15–16
		23	25	10.6	25

[1] Continued from preceeding month.
[2] Estimated.
[3] Due to manipulation of dam No .24.
[4] Continued into following month.
[5] Estimated, gage out.

CLIMATOLOGICAL DATA

CONDENSED CLIMATOLOGICAL SUMMARY OF TEMPERATURE AND PRECIPITATION BY SECTIONS

[For description of tables and charts, see REVIEW, January 1941, p. 32]

In the following table are given for the various sections of the climatological service of the Weather Bureau the monthly average temperature and total rainfall; the stations reporting the highest and lowest temperatures, with dates of occurrence; the stations reporting the greatest and least total precipitation; and other data as indicated by the several headings.

The mean temperature for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperatures and precipitation are based only on records from stations that have 10 or more years of observations. Of course, the number of such records is smaller than the total number of stations.

Section	Temperature								Precipitation					
			Monthly extremes								Greatest monthly		Least monthly	
	Section average	Departure from the normal	Station	Highest	Date	Station	Lowest	Date	Section average	Departure from the normal	Station	Amount	Station	Amount
	°F.	°F.		°F.			°F.		In.	In.		In.		In.
Alabama	43.3	−3.2	2 stations	78	[1] 18	Madison	0	8	3.37	−1.47	Fairihope	7.44	Talladega	0.60
Arizona	42.6	+.7	3 stations	82	27	Alpine	−21	5	.62	−.70	Pinal Ranch	2.11	Montezuma Well	.00
Arkansas	38.1	−3.1	Arkadelphia	83	[1] 23	2 stations	−21	8	3.20	−1.17	St. Francis	6.28	Warren	.90
California	45.8	+1.1	Yorba Linda	87	[1] 14	Sierraville	−23	2	4.17	−.67	Cummings	20.10	3 stations	.00
Colorado	22.1	−1.8	Florence	70	28	Taylor Park	−38	6	.69	−.09	Columbine	2.98	2 stations	T
Florida	56.8	−2.1	2 stations	89	[1] 3	Mason	9	11	3.79	+1.01	Pompano	12.51	Daytona Beach	1.08
Georgia	45.5	−1.4	Waycross	79	18	Hollywood	−2	11	4.46	+.24	Quitman	10.73	Cedartown	1.73
Idaho	19.9	−4.1	Pierce	58	25	Island Park Dam	−45	4	1.38	−.78	Deadwood Dam	3.66	Lifton	.43
Illinois	27.9	+.2	2 stations	68	24	Freeport	−24	10	1.47	−.90	Brookport	6.08	Shelbyville	.09
Indiana	28.6	−.4	Marengo	67	24	Forest Reserve	−23	8	1.79	−1.29	Forest Reserve	4.31	Anderson	.34
Iowa	21.6	+3.0	Ottumwa	64	23	Decorah	−36	4	.76	−.34	Grundy Center	1.93	2 stations	.12
Kansas	30.3	+.5	Independence	72	23	Syracuse	−27	5	.37	−.32	Pittsburg	1.47	2 stations	.03
Kentucky	32.7	−3.0	3 stations	70	24	St. John	−23	8	2.93	−1.59	Paducah	5.70	Greenup	1.43
Louisiana	47.8	−3.8	New Orleans (Audubon).	82	18	2 stations	10	8	2.73	−2.10	Cinclare	10.57	New Orleans (Airport).	.63
Maryland-Delaware	32.3	−.9	2 stations	66	[1] 18	Oakland, Md	−19	8	2.47	−.89	Easton, Md	4.10	Westminster, Md	1.18
Michigan	21.5	+.6	2 stations	57	[1] 23	Vanderbilt	−35	10	1.82	−.07	Mancelona	4.56	2 stations	.33
Minnesota	17.7	+8.2	2 stations	62	[1] 21	4 stations	−33	[1] 4	.19	−.56	Pigeon River Bridge	2.91	7 stations	T
Mississippi	43.4	−3.8	Fruitland Park	82	18	2 stations	0	8	2.70	−2.37	Dlo	8.03	Holly Bluff	.95
Missouri	31.1	+.4	3 stations	74	[1] 23	2 stations	−24	8	1.66	−.73	Fisk	5.83	Marshall	.05
Montana	19.5	−.1	2 stations	65	21	West Yellowstone	−48	4	.53	−.39	Hebgen Dam	2.68	5 stations	T
Nebraska	24.8	+1.7	Butte	68	22	Gordon	−32	[1] 4	.27	−.26	Auburn	1.36	2 stations	.00
Nevada	30.0	+.4	Desert Game Range	83	10	2 stations	−28	[1] 4	.99	−.21	Marlette Lake	8.15	8 stations	.00
New England	21.6	−.9	Boston, Mass	60	2	2 stations	−29	9	3.03	−.43	Lake Cochituate, Mass.	5.12	Enosburg Falls, Vt	1.11
New Jersey	28.9	−2.0	Hammonton	66	19	Pleasantville	−23	11	2.98	−.67	Elizabeth	4.30	Long Valley	2.26
New Mexico	34.1	+.5	Agricultural College	78	26	Gavilan	−37	5	.25	−.33	Luna Ranger Station.	1.62	11 stations	.00
New York	22.4	−.7	Mohonk Lake	62	3	Stillwater Reservoir	−42	8	2.01	−.90	Cutchogue	4.60	Penn Yan	.58
North Carolina	39.6	−1.8	2 stations	74	[1] 20	Banners Elk	−14	11	2.53	−1.20	Rock House	6.39	Williamston	1.03
North Dakota	18.3	+11.8	4 stations	60	22	5 stations	−35	3	.09	−.38	Hannah	.46	Milnor	.00
Ohio	28.5	+.1	2 stations	65	18	2 stations	−21	[1] 6	1.48	−1.57	Fernbank	2.32	Lakeview	.54
Oklahoma	37.0	−1.2	Hugo	80	24	Beaver	−17	5	.74	−.70	Kiamicki Tower	4.06	Tipton	.03
Oregon	28.2	−3.6	Port Oxford	70	21	Meacham	−30	1	2.75	−1.04	Illahe	11.50	Paisley	.71
Pennsylvania	26.6	−1.7	Butler	64	24	Lawrenceville	−30	8	1.81	−1.38	Mauch Chunk	3.41	Ansonia	.81
South Carolina	44.8	−1.0	Georgetown	77	19	Cherokee (near)	1	11	2.66	−.88	Caesars Head	5.33	McColl No. 1	1.33
South Dakota	23.5	+6.7	2 stations	68	[1] 22	Ralph	−34	7	.06	−.48	Dumont	.62	4 stations	.00
Tennessee	36.0	−3.0	London	75	24	Union City	−23	8	3.87	−.96	Dresden	6.45	Bluff City	1.94
Texas	45.4	−2.8	Laredo	92	26	Miami	−15	5	.66	−1.03	Liberty	3.59	11 stations	.00
Utah	23.0	−2.2	2 stations	67	[1] 25	Woodruff	−37	4	.98	−.24	Alta	5.53	3 stations	.00
Virginia	34.7	−1.7	Columbia	71	24	Elkwood	−14	11	2.54	−.74	Floyd	5.47	Moores Creek Dam	.31
Washington	28.9	−1.7	Everett	67	21	Stockdill Ranch	−18	1	2.56	−2.42	Quinault	12.58	Mottinger	.39
West Virginia	30.7	−1.9	5 stations	67	[1] 18	Benson	−23	8	2.02	−1.58	Pickens	3.96	Franklin	1.16
Wisconsin	18.3	+3.1	6 stations	57	23	Hillsboro	−36	7	.69	−.55	Whitewater	2.40	Weyerhauser	.04
Wyoming	17.1	−2.8	Wheatland	63	28	Buffalo Ranch	−45	4	.49	−.29	Bechler River	3.24	4 stations	.00
Alaska (December)	8.3	+3.3	Chitina	59	8	Fort Yukon	−58	4	1.77	−.90	La Touche	16.94	Nenanageir	.03
Hawaii	69.2	+.6	Kaneoke	88	25	Kanalohuluhulu	34	[1] 3	2.24	−6.23	Honomaele	13.05	4 stations	.00
Puerto Rico	74.4	+1.6	Rio Piedras	95	23	Lares	51	21	3.77	−.05	La Mina (El Yunque).	14.43	Vieques (Colonia Resolucion).	.00
Hawaii (December)	69.6	−.5	Olaa, Hawaii	90	29	Volcano Obs'y, Hawaii.	39	29	6.39	−2.56	Kukui, Maui	43.00	5 stations	.00

[1] Other dates also.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS, JANUARY 1942

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max.+mean min.÷2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch, or more	Wind: Average hourly velocity	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month	Thunderstorms
	Ft.	Ft.	Ft.	In.	In.	In.	°F.	°F.	°F.		°F.	°F.		°F.	°F.	°F.	°F.	%	In.	In.		Miles								0-10	In.	In.	
New England							22.9	+0.1										60	3.29	−0.1							5.2						
Eastport	75	67	85	29.89	29.98	−0.02	20.2	−0.2	49	2	29	−12	8	11	43	19	15	78	2.68	−1.2	13	11.7	nw.	42	s.	2	10	9	12	5.6	11.3	T	0
Greenville, Maine	1,070	6	41	28.77	30.00	.....	11.2	−1.0	48	18	23	−28	9	−1	49	9	6	...	2.47	−.4	12	.....	nw.	...	.....	...	7	12	12	.....	11.5	11.9	0
Portland, Maine [1]	103	5	36	29.88	30.00	−.05	20.8	.....	49	2	31	−16	8	11	42	18	11	69	3.20	−.8	7	9.4	sw.	39	se.	2	15	6	10	5.1	3.6	.2	1
Concord [2]	289	54	72	29.68	30.01	−.04	20.3	−1.3	56	2	32	−25	8	8	45	16	10	69	2.81	−.2	8	7.5	nw.	29	nw.	16	10	11	10	5.2	8.9	2.0	0
Burlington [2]	403	11	48	29.55	30.01	−.04	17.8	−1.0	45	2	26	−17	8	9	36	16	12	76	1.43	−.3	14	11.1	s.	41	s.	14	5	5	21	7.2	9.3	1.8	0
Northfield	876	12	60	29.02	30.02	−.03	17.5	+2.3	51	18	28	−23	8	6	54	...	...	...	2.28	−.1	11	8.3	sw.	26	sw.	18	7	8	16	6.7	12.5	4.2	0
Boston [1]	124	33	62	29.88	30.02	−.03	28.6	.....	60	2	36	1	8	21	30	24	17	63	3.69	+.1	7	12.5	sw.	35	s.	2	11	9	11	5.6	8.2	.0	0
Nantucket	12	10	63	30.00	30.01	−.03	31.4	+.1	54	2	38	8	11	24	28	28	25	79	4.24	+.5	11	12.5	w.	44	ne.	28	10	5	16	6.4	18.7	7.0	1
Block Island	26	11	46	30.00	30.03	−.04	30.4	−.6	55	2	38	8	8	23	26	28	22	69	4.03	+.2	11	19.1	w.	47	nw.	16	16	4	11	4.4	7.9	1.5	0
Providence [3]	159	46	60	29.86	30.04	−.02	29.0	+1.8	57	2	37	1	8	21	30	23	18	73	3.98	+.3	10	9.6	w.	34	sw.	2	9	8	14	5.9	13.6	1.0	0
Hartford [1]	159	5	44	29.86	30.04	−.03	25.1	.....	56	2	35	−10	11	16	37	22	17	72	4.20	+.3	9	9.5	n.	32	sw.	2	10	12	9	5.5	7.1	.0	1
New Haven [2]	107	74	153	29.94	30.06	−.02	28.7	+.5	55	2	36	0	8	21	30	25	20	76	4.42	+.4	9	9.4	sw.	31	s.	2	11	12	8	6.0	9.0	T	1
Middle Atlantic States							33.4	0.0										64	2.51	−0.7							5.5						
Albany [1]	97	26	40	29.94	30.04	−.03	22.0	.....	53	2	31	−17	8	13	36	19	14	70	1.71	−.7	10	10.5	s.	36	nw.	14	9	7	15	6.0	11.5	.8	0
Binghamton	871	57	79	29.09	30.05	−.03	24.7	+.6	51	23	33	−15	8	16	39	22	18	78	1.60	−.8	14	6.2	w.	20	sw.	2	6	7	18	7.1	9.3	.0	0
New York	314	415	454	29.70	30.06	−.04	30.9	.0	57	24	38	5	8	23	26	27	19	61	3.17	−.5	10	17.2	nw.	58	se.	31	10	11	10	5.2	6.2	T	3
Harrisburg [1]	374	30	49	29.66	30.08	−.02	29.1	.....	59	24	37	−3	9	21	30	26	20	68	2.37	−.7	8	7.9	w.	32	nw.	16	11	6	14	5.5	7.7	.0	0
Philadelphia [2]	114	74	367	29.96	30.08	−.03	32.5	−.1	59	2	40	6	8	26	27	27	22	72	2.34	−1.0	10	13.8	n.	44	s.	31	10	9	12	5.4	5.3	.0	1
Reading	323	47	306	29.72	30.09	.....	30.2	−1.0	57	24	38	2	8	22	29	26	18	60	2.49	−1.1	11	11.7	nw.	44	w.	2	10	8	13	5.5	7.3	.0	0
Scranton	805	72	164	29.16	30.06	−.03	26.4	−.2	53	2	34	−8	8	18	29	...	...	...	1.36	−1.7	8	7.2	sw.	25	nw.	16	7	12	12	5.8	7.5	.0	1
Atlantic City	52	37	172	30.02	30.08	−.03	33.7	+1.2	59	2	41	9	8	26	26	30	23	66	2.92	−.6	8	16.6	w.	52	se.	31	12	8	11	5.5	3.3	.0	0
Trenton	190	89	107	29.87	30.08	.....	30.2	−.3	59	2	38	2	11	23	27	27	20	65	2.82	−.5	9	9.6	nw.	31	w.	2	11	8	12	5.5	6.4	.0	1
Baltimore [2]	123	100	215	29.96	30.09	−.03	35.8	+2.0	65	18	43	8	8	28	31	30	23	65	2.04	−1.5	10	11.6	sw.	42	sw.	31	12	9	10	5.0	3.0	.0	0
Washington [1]	112	62	85	29.97	30.10	−.03	34.8	−1.4	65	18	42	7	8	27	32	30	24	67	2.47	−1.1	10	7.3	nw.	26	nw.	2	15	6	10	4.9	1.8	.0	0
Cape Henry	18	8	54	30.06	30.08	.....	40.0	−.2	68	2	47	12	11	33	29	36	31	75	2.49	−.7	10	12.4	n.	47	n.	28	11	7	13	5.5	3.0	.0	1
Lynchburg	686	144	184	29.35	30.12	−.01	37.6	+.1	66	25	47	7	11	28	33	32	24	62	2.77	−.7	11	7.5	nw.	31	nw.	15	13	7	11	4.9	2.3	.0	0
Norfolk [2]	91	80	125	30.00	30.10	−.03	41.1	+.5	67	18	49	12	11	33	27	34	30	77	2.76	−.3	10	9.6	n.	32	n.	28	12	6	13	5.4	2.4	.0	0
Richmond [2]	144	11	52	29.94	30.10	−.04	36.8	−1.1	67	24	46	2	11	27	36	30	25	74	4.33	+1.1	10	8.5	sw.	34	sw.	31	16	3	12	4.7	5.2	.0	1
South Atlantic States							46.8	+0.1										73	2.61	−1.0							4.9						
Asheville	2,253	89	104	27.72	30.14	−.01	37.4	+2.0	68	24	47	−2	11	28	41	31	26	71	2.18	−.9	11	9.6	nw.	28	se.	31	12	8	11	5.4	3.1	T	0
Charlotte [2]	779	63	86	29.25	30.10	−.05	42.3	+1.1	69	24	52	11	11	33	34	29	72	1.86	−2.1	10	6.9	sw.	26	sw.	31	9	10	12	5.7	1.4	.0	0
Greensboro [1]	886	6	56	29.15	30.12	.....	36.4	.....	66	25	48	−5	11	25	39	31	26	72	2.36	.....	9	7.8	sw.	29	sw.	31	12	7	12	5.4	4.7	.0	1
Hatteras	11	5	50	30.08	30.09	−.05	45.6	−1.5	67	19	52	24	11	39	24	42	39	84	3.75	−.7	9	13.4	n.	41	n.	28	15	4	12	4.9	2.5	.0	1
Raleigh [1]	376	27	69	29.70	30.11	−.02	40.6	.....	71	25	51	6	11	30	35	34	27	66	1.29	−2.4	8	9.0	sw.	34	w.	2	11	12	8	5.0	.5	.0	1
Wilmington	72	73	107	30.04	30.12	−.02	46.4	−.1	70	19	56	17	11	37	30	40	35	72	2.05	−1.2	8	9.1	n.	37	sw.	31	13	9	9	4.5	.4	.0	0
Charleston [2]	48	11	92	30.07	30.12	−.03	49.6	−.3	74	19	58	24	11	42	28	41	38	79	2.88	−.1	7	9.9	n.	29	e.	3	14	8	9	4.6	.0	.0	1
Columbia, S. C. [3]	347	70	91	29.73	30.11	−.04	46.4	+.4	72	25	57	15	11	36	33	39	34	74	2.20	−1.2	8	8.4	sw.	29	sw.	31	11	12	8	4.9	T	.0	2
Greenville, S. C. [1]	1,040	70	78	28.99	30.11	.....	41.4	.....	69	24	51	12	11	32	37	35	29	68	2.84	−2.0	9	8.9	sw.	39	n.	28	11	11	9	5.1	1.2	.0	0
Augusta [2]	182	62	77	29.92	30.12	−.04	47.2	+.2	73	24	58	17	11	36	36	40	33	65	3.12	−.8	7	5.7	nw.	22	w.	31	11	13	7	4.9	.0	.0	2
Savannah [2]	65	73	52	30.06	30.14	−.01	51.6	+.2	75	24	62	21	11	41	32	42	38	73	3.41	+.6	9	10.6	nw.	29	nw.	28	12	10	9	4.9	.0	.0	0
Jacksonville [2]	43	86	110	30.10	30.14	−.01	54.5	−.9	77	19	65	25	11	44	30	45	42	78	3.13	+.3	5	7.8	nw.	25	sw.	27	14	12	5	3.7	.0	.0	2
Florida Peninsula							67.4	−0.6										82	2.54	+0.1							5.5						
Key West [2]	21	10	64	30.07	30.09	−.01	68.3	−1.2	85	2	74	52	24	63	18	63	61	84	2.38	+.4	9	9.9	ne.	27	nw.	28	11	10	10	5.4	.0	.0	2
Miami [2]	25	124	168	30.08	30.10	−.03	66.5	.0	83	2	74	44	11	59	24	58	56	83	2.02	−.5	9	10.6	n.	26	w.	28	8	7	16	6.1	.0	.0	0
Tampa [1]	35	5	61	30.11	30.14	+.02	58.2	.....	76	3	67	31	11	49	29	52	48	78	3.21	+.5	11	10.2	n.	29	s.	2	12	7	12	4.9	.0	.0	0
East Gulf States							46.9	−2.1										60	3.63	−1.1							3.5						
Atlanta [1]	1,173	5	72	28.87	30.14	−.01	42.6	.....	70	25	53	13	8	32	32	35	28	63	3.47	−1.6	7	11.2	nw.	34	w.	31	13	8	10	4.9	.1	.0	3
Macon [2]	370	79	87	29.74	30.14	−.02	46.0	−.8	74	24	58	15	11	35	38	38	32	68	3.75	−.4	4	7.4	nw.	25	s.	31	15	7	9	4.4	T	.0	2
Thomasville	273	49	58	29.87	30.18	+.02	48.7	−2.3	76	18	60	20	11	38	36	...	...	...	8.59	+4.5	7	.....	...	...	.....	...	15	9	7	.....	.0	.0	2
Apalachicola	35	11	51	30.12	30.16	.....	52.0	−1.7	76	19	61	23	11	43	26	46	43	77	5.10	+1.4	8	9.0	n.	25	nw.	27	18	8	5	3.4	.0	.0	3
Pensacola	56	54	79	30.12	30.18	+.04	49.6	−2.9	73	1	58	20	11	41	26	44	39	72	4.39	+.4	7	8.4	n.	26	s.	30	18	5	8	3.9	.0	.0	7
Anniston	741	9	...	.....	.....	.....	42.8	+.6	70	24	55	10	11	31	35	...	...	...	2.48	−2.7	8	.....	nw.	...	.....	...	8	13	10	.....	.1	.0	0
Birmingham [2]	700	11	48	29.42	30.18	+.02	42.8	−2.3	71	24	53	7	8	33	32	34	29	72	1.89	−3.6	7	7.7	n.	30	se.	1	16	5	10	4.4	T	.0	0
Mobile [2]	57	6	30	30.13	30.19	+.04	48.4	−3.1	75	1	58	18	11	39	32	41	37	76	4.10	−.8	8	10.9	n.	30	s.	30	15	9	7	4.5	.0	.0	3
Montgomery [2]	218	92	105	29.94	30.18	+.02	46.0	−2.2	71	26	56	16	11	36	31	38	32	69	4.00	−1.2	7	7.8	n.	21	se.	30	15	6	10	4.5	.1	.0	3
Meridian [2]	375	67	92	29.78	30.20	+.04	43.4	−3.6	72	23	55	10	8	32	41	36	32	75	2.60	−2.7	6	6.3	n.	25	s.	30	16	8	7	3.9	.3	.0	2
Vicksburg [2]	247	82	102	29.92	30.20	+.05	44.8	−3.4	74	23	54	10	8	35	35	34	30	73	1.88	−3.5	5	9.1	n.	30	w.	30	14	7	10	4.5	T	.0	2
New Orleans [2]	53	76	84	30.14	30.19	+.06	51.5	−1.7	78	1	60	26	8	43	28	44	39	70	1.32	−3.0	5	7.4	ne.	21	se.	30	16	7	8	3.8	.0	.0	3
West Gulf States							46.7	−1.6										72	0.93	−1.9							5.2						
Shreveport [1]	249	92	227	29.94	30.22	+.08	44.9	.....	77	23	56	15	8	34	41	39	34	71	1.12	−2.8	5	11.9	nw.	40	w.	30	16	4	11	4.7	T	.0	2
Bentonville	1,303	12	51	28.77	30.20	+.06	34.0	−.1	70	23	45	−4	5	23	35	...	...	...	1.28	−1.4	7	7.6	sw.	21	sw.	17	11	18	2	...	5.7	...	2
Fort Smith	463	57	82	.....	30.21	+.07	37.6	−1.9	73	23	48	3	5	27	...	...	...	...	2.19	−.4	6	7.7	e.	26	se.	30	15	10	6	...	4.4	.0	3
Little Rock [2]	357	94	102	29.81	30.20	+.05	39.8	−1.6	73	23	49	6	8	30	40	33	28	73	2.72	−2.0	7	8.2	nw.	27	w.	30	13	8	10	4.7	2.7	.0	4
Austin [2]	605	68	90	29.58	30.23	.....	48.6	−.9	82	25	60	17	8	37	40	41	34	66	.07	−2.0	4	7.8	n.	25	w.	30	9	11	11	5.7	.0	.0	0
Brownsville [2]	57	88	96	30.11	30.17	.....	57.6	−2.2	81	30	65	33	8	50	23	52	50	83	.60	−1.1	7	11.0	n.	30	nw.	3	9	8	14	6.0	.0	.0	0
Corpus Christi [2]	20	11	78	30.18	30.20	+.10	54.2	−1.8	78	26	62	27	8	47	27	47	44	78	.14	−1.4	4	10.4	n.	28	nw.	30	13	7	11	4.8	.0	.0	1
Dallas [1]	512	6	46	29.67	30.23	.....	42.8	.....	78	23	55	10	5	30	44	36	29	66	.47	−1.9	4	9.7	n.	38	nw.	30	14	6	11	5.2	1.0	.0	1
Fort Worth [1]	679	35	56	29.50	30.24	+.12	43.1	.....	78	25	55	9	5	31	41	36	29	65	.39	−1.7	4	11.0	nw.	43	nw.	30	11	12	8	5.0	1.3	.0	1
Galveston [2]	54	106	114	30.15	30.21	+.08	51.6	−2.2	74	30	57	28	8	46	25	46	43	80	.77	−2.6	7	10.2	n.	30	se.	30	10	10	11	5.2	.6	.0	2
Houston [2]	138	157	190	30.07	30.23	.....	51.4	−1.3	76	24	60	28	10	42	35	44	39	74	.98	−2.7	7	10.4	n.	29	nw.	30	14	6	11	5.2	.0	.0	2
Palestine	510	64	72	29.69	30.23	+.11	45.8	−2.4	77	25	56	15	8	36	40	39	32	64	.57	−2.9	5	7.6	n.	28	w.	30	11	10	10	4.9	T	.0	2
Port Arthur	34	59	134	30.18	30.21	.....	50.4	.....	76	30	59	24	8	42	32	44	39	72	1.58	−2.1	8	12.9	n.	45	s.	30	14	7	10	4.7	.0	.0	4
San Antonio [1]	693	28	59	29.47	30.22	+.12	50.2	.....	82	26	62	23	8	38	43	43	36	66	.13	−1.3	4	8.3	ne.	31	nw.	30	11	6	14	5.6	.0	.0	0
Ohio Valley and Tennessee							32.0	−0.7										75	2.27	−1.5							5.9						
Chattanooga [1]	762	21	54	29.32	30.16	.00	37.6	.....	69	24	50	6	8	25	43	32	27	74	3.45	.....	8	6.7	s.	28	w.	31	9	9	13	5.7	.2	.0	2
Knoxville [2]	995	66	84	29.06	30.14	−.01	37.6	−1.2	66	24	47	4	8	28	34	32	26	68	3.63	−1.0	9	5.8	w.	24	w.	31	8	10	13	6.1	1.9	.0	2
Memphis [2]	399	78	86	29.75	30.19	+.03	36.9	−4.0	70	24	48	1	8	26	39	32	28	76	4.35	−.5	7	8.6	sw.	34	w.	30	14	8	9	4.7	1.4	.0	4
Nashville [1]	546	5	72	29.56	30.17	+.01	35.0	.....	71	24	46	−9	8	24	35	30	25	72	2.81	−2.0	7	9.0	s.	29	sw.	31	12	5	14	5.5	5.3	T	1
Lexington	989	6	...	29.05	30.16	+.03	31.5	−1.4	65	24	42	−11	8	21	32	...	...	...	3.38	−.8	10	.....	s.	...	.....	...	12	7	12	5.2	9.3	.4	0
Louisville [2]	525	160	120	29.55	30.14	.00	32.8	−1.6	65	24	41	−4	8	25	28	27	22	73	2.58	−1.4	8	10.0	sw.	34	sw.	31	15	4	12	5.1	5.2	T	0
Evansville [1]	431	5	38	29.67	30.15	+.01	30.6	.....	66	24	41	−15	8	21	36	27	23	77	2.68	−1.1	7	9.1	sw.	34	w.	1	12	5	14	5.4	5.1	T	1
Idnianapolis [2]	823	98	129	29.18	30.10	−.02	29.2	+.8	58	24	37	−7	8	22	31	24	21	80	1.20	−1.8	4	9.3	sw.	32	w.	31	12	3	16	5.8	T	T	1
Terre Haute [2]	575	68	149	29.50	30.14	.....	29.8	.....	62	24	38	−6	8	21	32	24	21	80	1.24	−1.5	8	10.6	sw.	34	sw.	1	12	5	14	5.3	.8	.1	0

See footnotes at end of table.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS, JANUARY 1942—Continued

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max.+mean min.÷	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch, or more	Wind: Average hourly velocity	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month	Thunderstorms
Other Valley and Tennessee—Con.																																	
	Ft.	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	*°F.*	*°F.*	*°F.*		*°F.*	*°F.*		*°F.*	*°F.*	*°F.*	*°F.*	%	*In.*	*In.*		*Miles*								*0–10*	*In.*	*In.*	
Cincinnati [2]	627	11	51	29.42	30.13	+.01	31.3	+1.0	61	24	39	−7	8	23	28	27	23	77	2.02	−1.5	12	9.1	sw.	31	w.	31	10	6	15	5.8	5.3	.1	1
Columbus [2]	822	90	110	29.18	30.09	−.02	29.4	+.8	57	18	37	−7	8	22	23	25	21	78	1.24	−1.8	9	11.1	s.	42	sw.	2	9	4	18	6.7	2.8	.3	1
Dayton [2]	900	106	213	29.10	30.10	.....	29.7	+.2	56	24	37	−6	8	23	23	25	22	83	1.55	−1.7	9	11.8	sw.	48	sw.	2	8	5	18	6.3	3.2	.2	1
Elkins [2]	1,947	61	78	27.98	30.11	−.01	29.4	−1.0	62	18	40	−7	11	19	44	25	20	75	2.01	−1.8	11	7.2	w.	27	sw.	31	4	11	16	6.9	4.1	T	1
Parkersburg	637	77	84	29.40	30.10	−.02	32.0	−.5	62	18	40	−7	8	24	36	28	23	73	1.53	−2.0	10	6.5	se.	25	sw.	2	6	8	17	6.9	4.2	.1	0
Pittsburgh [1]	842	39	54	29.15	30.07	−.04	29.0	.....	59	18	37	−9	8	21	34	25	19	70	1.54	−1.5	9	12.0	sw.	43	sw.	2	6	11	14	6.5	5.5	T	1
Lower Lake Region							24.4	+0.4										80	1.88	−0.7									7.5			
Buffalo [2]	768	243	280	29.16	30.02	−.05	24.2	−.4	45	18	30	−5	8	18	33	22	18	77	3.25	.0	18	18.4	sw.	65	w.	2	4	6	21	8.0	31.0	.0	0
Canton	448	10	61	29.51	30.01	.....	15.8	−.5	47	2	25	−23	8	6	41	15	13	87	2.62	+.1	19	10.1	sw.	38	w.	2	8	3	20	7.0	15.1	2.2	0
Ithaca	836	77	100	.....	.....	.....	24.9	+.6	52	23	32	−8	8	18	31	.....	.....	.....	1.30	−.9	16	10.4	nw.	36	se.	1	5	3	23	7.7	11.0	.0	0
Oswego	335	71	85	29.64	30.02	−.05	23.8	−.1	48	18	31	−4	8	16	33	22	16	72	2.31	−.6	16	11.2	s.	30	sw.	7	1	6	24	8.4	24.3	1.5	0
Rochester [1]	523	5	69	29.44	30.03	−.04	24.4	.....	50	18	32	−10	8	17	38	22	19	83	1.28	−1.6	16	12.5	sw.	46	w.	2	6	5	20	7.3	5.0	.0	0
Syracuse [1]	596	5	51	29.36	30.03	−.04	24.2	.....	50	23	32	−8	8	16	45	21	18	79	1.59	−1.4	16	11.5	sw.	38	sw.	2	8	3	20	7.2	9.5	.0	0
Erie [2]	714	57	81	29.24	30.04	−.04	27.4	+.6	51	18	33	0	6	22	33	24	21	85	1.64	−1.1	13	10.2	sw.	29	sw.	2	1	7	23	8.5	8.5	.0	1
Cleveland [1]	762	27	54	29.30	30.06	−.03	27.3	.....	53	18	35	−9	8	20	30	24	21	80	1.79	−.7	14	12.5	sw.	43	sw.	2	6	4	21	7.3	5.6	T	0
Sandusky	629	5	67	.....	.....	.....	28.0	+1.7	55	23	35	−5	8	21	29	.....	.....	.....	1.09	−1.2	10	10.8	sw.	34	sw.	2	6	5	20	7.2	2.1	.7	0
Toledo [2]	628	79	87	29.35	30.06	−.03	26.5	+.7	53	23	33	−8	8	20	31	23	19	79	1.75	−.4	8	11.4	w.	35	w.	6	6	5	20	7.1	1.1	.3	0
Fort Wayne [1]	857	69	84	29.12	30.07	.....	25.4	.....	52	23	32	−10	8	18	29	24	21	84	1.91	−.4	7	10.7	sw.	35	sw.	1	7	6	18	6.8	1.1	T	0
Detroit [1]	730	5	78	29.22	30.04	−.04	25.8	.....	52	23	32	−5	7	20	23	23	18	73	2.03	.0	9	12.3	sw.	40	sw.	6	6	6	19	7.2	3.3	.5	0
Upper Lake Region							20.6	+2.9										81	1.24	−0.6									6.9			
Alpena	609	5	89	29.29	29.98	−.06	21.4	+2.3	46	23	28	−8	10	15	27	20	17	84	1.71	−.2	14	11.8	sw.	35	nw.	14	4	7	20	7.8	13.7	5.8	0
Escanaba	612	51	72	29.31	30.01	−.04	19.0	+3.6	53	23	26	−20	7	12	26	17	13	80	.42	−1.1	8	11.6	sw.	42	n.	1	6	11	14	6.5	8.6	3.1	0
Grand Rapids [2]	707	70	244	29.22	30.01	−.05	25.6	+1.1	47	24	31	−6	7	20	22	22	19	87	2.53	+.2	17	12.7	sw.	44	sw.	1	4	4	23	8.1	31.2	7.0	0
Lansing [2]	878	5	90	29.05	30.03	.....	23.2	+.8	48	24	30	−9	8	17	25	21	18	83	2.15	+.3	13	10.0	sw.	29	sw.	1	5	7	19	7.4	13.9	5.4	0
Marquette	734	44	73	29.14	29.97	−.07	20.6	+4.3	52	23	27	−15	7	14	26	18	14	77	.52	−1.8	14	10.4	w.	36	sw.	17	5	10	16	7.2	5.3	2.0	0
Sault Sainte Marie [2]	614	11	52	29.26	29.96	−.07	14.5	+1.2	40	17	23	−23	10	6	37	13	11	84	1.42	−.6	16	11.4	e.	39	nw.	14	2	7	22	8.3	13.5	4.0	0
Chicago	673	7	131	29.32	30.08	−.02	25.6	+1.9	50	23	32	−13	7	20	28	23	19	75	1.39	−.5	6	11.8	sw.	32	n.	31	9	6	16	6.5	4.6	2.6	0
Green Bay	617	109	141	29.32	30.02	−.04	18.8	+2.1	46	23	26	−22	7	12	27	18	15	80	.78	−.8	6	12.2	sw.	40	n.	1	11	6	14	5.7	8.4	.1	0
Milwaukee [1]	681	33	66	29.28	30.05	−.03	20.0	.....	44	23	28	−23	8	12	36	19	16	82	1.16	−.6	6	13.7	sw.	37	sw.	10	8	11	12	5.9	8.1	4.2	1
Duluth	1,133	5	47	28.74	30.02	−.07	17.0	+9.1	55	23	26	−26	7	8	35	13	10	82	.31	−.7	5	14.5	nw.	55	nw.	14	12	8	11	5.4	3.1	2.6	0
North Dakota							18.3	+13.4										79	0.08	−0.4									5.0			
Moorhead, Minn. [2]	940	50	58	29.01	30.08	−.06	18.0	+14.2	52	23	27	−22	7	9	30	14	11	82	.07	−.6	4	8.9	nw.	33	nw.	13	8	9	14	6.1	.8	T	0
Bismarck [1]	1,677	4	41	28.26	30.14	+.01	19.4	+11.6	54	24	32	−28	7	7	41	16	12	76	.04	−.4	2	10.5	nw.	43	nw.	13	14	10	7	4.4	.7	.1	0
Devils Lake	1,478	11	44	28.42	30.07	−.05	16.1	+14.3	47	23	25	−27	7	7	33	14	12	85	.04	−.4	2	9.6	w.	34	nw.	13	8	10	13	6.1	.7	.3	0
Lemmon, S. D.	2,602	4	38	27.32	30.16	.....	22.0	.....	57	22	35	−27	5	9	37	18	12	.....	.02	.....	1	.....	w.	.....	.....	.....	15	9	7	.....	.....	.3	.0	0
Grand Forks	832	11	71	29.12	30.07	.....	15.7	.....	51	23	26	−26	7	6	34	14	11	.....	.18	.....	6	.....	.....	.....	.....	.....	8	7	16	.....	2.1	.6	0
Williston	1,878	42	50	28.08	30.15	+.04	19.7	+13.3	50	25	30	−27	3	9	35	16	11	73	.15	−.4	5	7.3	sw.	31	nw.	13	21	3	7	3.4	1.5	.7	0
Upper Mississippi Valley							25.0	+2.7										79	1.12	−0.5									4.9			
Minneapolis [1]—St. Paul, Minn. [1]	919	32	61	29.03	30.07	−.04	20.5	.....	53	23	29	−20	4	12	42	17	12	73	.15	−.7	2	10.6	nw.	38	nw.	14	14	6	11	4.8	1.7	T	0
Springfield, Minn.	1,025	4	42	28.95	30.10	.....	20.6	.....	53	22	29	−23	7	12	30	18	13	.....	.13	.....	1	.....	w.	.....	.....	.....	13	12	6	.....	1.8	T	0
La Crosse [2]	714	11	48	29.26	30.07	−.04	20.9	+4.8	50	22	29	−21	7	13	35	17	13	79	.59	−.5	3	6.1	s.	21	nw.	14	12	7	12	5.1	5.7	.2	0
Madison [2]	974	70	78	28.97	30.07	−.03	20.3	+3.6	48	23	27	−22	7	14	34	17	14	83	1.09	−.3	4	9.5	nw.	39	ne.	1	11	9	11	5.6	10.4	.5	0
Charles City	1,015	10	51	28.97	30.12	−.02	18.0	+4.3	45	23	27	−25	7	9	38	16	14	85	.85	−.2	1	6.6	nw.	20	nw.	1	14	8	9	4.2	8.9	.7	0
Davenport [2]	606	66	61	29.43	30.13	+.01	24.1	+2.3	54	23	32	−14	4	16	36	20	18	85	.93	−.5	4	10.2	nw.	25	se.	29	14	5	12	5.1	5.4	1.2	0
Des Moines [2]	861	5	99	29.17	30.13	−.01	23.5	+3.4	55	25	32	−17	10	15	46	20	16	79	1.18	+.1	1	10.5	nw.	30	n.	1	15	9	7	4.2	17.7	T	0
Dubuque	699	60	79	29.31	30.10	−.02	21.8	+2.7	48	23	30	−17	7	14	36	19	15	78	1.01	−.3	3	6.7	nw.	22	nw.	31	14	4	13	5.0	10.9	T	0
Burlington, Iowa	35	6	702	29.33	30.12	.....	24.5	.....	58	23	33	−14	10	16	39	22	16	73	.57	−1.1	3	.....	.....	.....	.....	.....	13	7	11	4.8	4.7	1.3	0
Cairo	358	87	93	29.78	30.18	+.02	34.2	−.7	65	24	42	−5	8	26	34	.....	.....	.....	3.12	−.6	8	9.0	sw.	30	sw.	1	10	11	10	5.3	5.4	.0	1
Peoria [2]	609	11	45	29.43	30.12	.00	25.6	+2.5	57	23	34	−11	10	17	28	22	20	84	1.22	−.6	6	6.8	w.	26	sw.	1	13	5	13	5.0	3.5	3.0	0
Springfield, Ill. [2]	636	5	191	29.42	30.13	.00	29.0	+2.5	57	23	38	−6	10	21	31	23	20	83	1.59	−.5	4	10.2	nw.	30	w.	1	13	6	12	5.6	2.4	2.2	0
St. Louis [2]	568	179	303	29.52	30.16	+.02	32.5	+1.4	67	23	41	−5	10	24	33	28	20	62	1.44	−.9	6	12.5	nw.	32	nw.	2	15	5	11	4.5	.6	.5	0
Missouri Valley							28.3	+2.7										77	0.33	−0.8									4.4			
Columbia, Mo. [2]	784	6	66	29.30	30.17	+.04	31.1	+1.9	69	23	41	−6	10	21	35	26	21	73	.38	−1.5	2	8.1	w.	32	nw.	9	14	10	7	4.4	2.0	.8	0
Kansas City [1]	963	38	76	29.11	30.19	+.03	31.5	.....	66	23	42	−6	4	22	34	27	21	70	.14	−1.0	2	10.9	sw.	32	nw.	31	14	9	8	4.3	.6	.0	0
St. Joseph [2]	967	11	49	29.11	30.19	.....	28.4	+2.9	62	26	38	−8	4	19	36	24	22	88	.28	−1.0	2	9.0	nw.	30	nw.	31	17	6	8	4.3	4.1	.0	0
Springfield, Mo. [1]	1,324	95	60	28.73	30.18	+.04	31.4	−2.1	68	23	42	−4	8	20	39	27	23	76	1.55	−.8	6	12.1	nw.	33	w.	1	15	4	12	4.7	4.6	2.8	0
Topeka	987	65	87	29.10	30.20	.....	31.0	+3.4	61	23	40	−6	4	22	31	27	21	72	.11	−.8	1	9.3	w.	28	nw.	9	14	8	9	4.1	.9	.0	0
Lincoln [2]	1,189	11	81	28.86	30.19	+.04	27.0	+4.2	56	25	35	−9	5	19	33	21	19	83	.27	−.4	3	9.4	s.	33	nw.	1	14	8	9	4.4	2.8	.0	0
Omaha [1]	1,105	31	44	28.94	30.18	+.03	25.2	+3.3	58	25	34	−12	4	16	40	22	18	78	.09	−.6	1	11.2	nw.	38	nw.	1	15	7	9	4.2	6.4	.0	0
Valentine	2,598	46	54	27.37	30.20	+.08	24.0	+5.1	57	22	36	−23	4	12	47	20	15	71	.13	−.4	4	9.0	w.	31	nw.	13	12	10	9	4.8	.7	.1	1
Sioux City [1]	1,138	5	27	28.89	30.16	+.01	22.2	.....	56	22	32	−24	4	12	52	20	16	81	.49	.....	1	10.0	nw.	32	nw.	1	14	9	8	4.3	5.3	.0	0
Huron [1]	1,301	26	41	28.69	30.14	−.02	22.6	.....	57	21	34	−24	7	12	35	19	15	77	.04	−.5	2	13.2	nw.	35	s.	28	17	7	7	4.0	.7	T	0
Northern Slope							21.4	+1.0										76	0.41	−0.3									5.3			
Billings [1]	3,570	18	39	26.42	30.22	.....	25.8	.....	49	23	35	−25	1	17	27	22	16	70	.40	.....	6	14.8	sw.	34	sw.	1	10	13	8	5.1	3.2	T	0
Havre	2,507	11	67	27.46	30.20	+.10	24.3	+1.4	50	24	36	−24	1	13	48	22	16	70	.04	−.7	2	10.2	sw.	30	w.	13	9	10	12	5.5	.6	.0	0
Helena [1]	4,124	5	35	25.95	30.43	+.28	9.8	.....	47	11	20	−37	5	−1	37	9	7	84	.60	−.3	7	4.4	w.	26	w.	13	12	5	14	5.4	10.6	6.0	0
Missoula [2]	3,205	80	91	26.85	30.42	.....	17.0	−5.3	44	24	24	−18	1	10	22	14	12	88	.55	−.5	6	4.3	w.	24	e.	3	5	10	16	7.2	10.6	.4	0
Kalispell	2,973	48	56	27.16	30.38	+.26	17.4	−3.0	43	25	23	−13	7	12	20	17	16	94	.79	−.8	11	3.6	w.	13	sw.	25	1	4	26	8.7	8.1	.7	0
Miles City [2]	2,371	48	55	27.62	30.22	+.10	23.6	+9.1	52	24	34	−28	1	13	34	19	15	75	.22	−.4	5	5.7	s.	32	nw.	13	14	8	9	4.5	1.6	.5	0
Rapid City [2]	3,259	50	58	26.69	30.19	+.09	28.2	+6.2	68	22	40	−18	5	16	39	21	14	64	.04	−.4	3	7.8	w.	37	nw.	13	18	6	7	4.1	.5	T	0
Cheyenne [1]	6,094	5	39	24.02	30.22	+.17	24.6	.....	59	28	37	−27	4	12	40	20	12	59	.77	+.4	7	12.1	nw.	34	nw.	5	9	11	11	5.2	11.5	2.0	0
Lander	5,352	60	68	24.76	30.40	+.18	10.6	−7.7	48	28	23	−32	5	−2	34	9	2	69	.55	.0	6	2.9	sw.	15	sw.	28	13	14	4	4.3	6.3	2.5	0
Sheridan [2]	3,790	6	42	26.19	30.23	.....	24.1	+4.6	54	23	36	−21	7	12	35	20	17	80	.30	−.6	8	6.6	nw.	35	nw.	2	12	8	11	5.1	3.5	.4	0
North Platte [2]	2,821	11	51	27.17	30.22	+.10	26.0	+3.1	62	22	38	−16	4	14	44	20	17	78	.25	−.1	6	7.7	w.	22	n.	1	17	7	7	3.5	2.0	T	0
Middle Slope							32.7	+2.1										70	0.29	−0.4									4.1			
Denver [1]	5,292	106	113	24.79	30.22	+.17	30.0	.....	60	28	41	−12	5	19	40	21	14	62	.65	+.2	4	7.2	s.	29	w.	25	17	8	6	3.9	7.7	4.8	0
Pueblo [1]	4,690	5	36	25.37	30.24	+.19	28.4	.....	65	24	45	−21	5	12	52	20	14	65	.11	−.2	3	7.0	w.	38	w.	8	15	12	4	3.6	3.5	.5	1
Concordia	1,392	50	58	28.68	30.21	+.07	28.8	+2.4	58	24	37	−8	2	20	30	25	22	80	.26	−.4	1	8.3	w.	27	nw.	1	15	8	8	4.2	6.4	.0	0
Dodge City	2,509	10	86	27.52	30.22	+.11	31.5	+2.5	68	22	45	−13	5	18	44	25	19	68	.10	−.3	4	10.9	nw.	31	s.	28	12	14	5	4.4	1.9	.0	0
Wichita [1]	1,358	6	64	28.72	30.21	+.08	32.0	.....	63	29	43	−2	5	21	34	27	23	78	.23	−.6	4	14.5	nw.	45	n.	30	16	8	7	4.1	2.2	.0	0
Oklahoma City [2]	1,214	10	47	28.90	30.23	+.12	37.8	+1.4	73	23	48	2	5	27	32	30	24	66	.37	−.8	4	9.3	nw.	26	nw.	30	10	17	4	4.5	2.2	.1	1

See footnotes at end of table.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS, JANUARY 1942—Continued

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max.+mean min.÷	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch, or more	Wind: Average hourly velocity	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month	Thunderstorms
	Ft.	Ft.	Ft.	In.	In.	In.	°F.	°F.	°F.		°F.	°F.		°F.	°F.	°F.	°F.	%	In.	In.		Miles								0–10	In.	In.	
Southern Slope							42.1	+0.2										62	0.15	−0.5										5.1			
Abilene [1]	1,738	10	56	28.36	30.21	+.12	43.0	−1.2	79	25	55	11	8	31	42	34	27	63	.08	−.9	3	8.6	s.	29	s.	29	9	9	13	5.5	.1	.0	1
Amarillo [2]	3,676	10	49	26.37	30.20	+.14	34.8	−.5	71	23	49	−5	5	20	55	27	20	64	.06	−.4	2	13.0	sw.	42	sw.	8	12	11	8	5.0	4.0	.0	0
Del Rio	960	63	71	29.16	30.17	+.11	50.5	+1.8	83	25	62	25	10	40	40	43	34	60	.30	−.3	2	8.2	se.	30	nw.	30	13	5	13	5.1	.0	.0	0
Roswell	3,566	75	85	26.49	30.18	+.14	40.0	+.8	73	25	54	16	4	27	43	34	26	63	.15	−.4	2	7.1	s.	33	w.	20	13	8	10	4.8	1.8	.0	0
Southern Plateau							33.5	+3.3										51	0.24	−0.4										4.4			
El Paso [2]	3,778	82	101	26.28	30.12	+.11	47.7	+2.7	74	28	60	26	5	36	37	37	26	50	.14	−.3	2	7.8	w.	27	ne.	14	11	12	8	4.6	.0	.0	1
Albuquerque [1]	5,314	5	45	24.83	30.16	.....	37.0	.....	63	23	50	9	5	24	35	29	20	53	.13	−.3	2	8.6	n.	38	e.	13	12	14	5	4.5	2.1	.0	0
Phoenix [3]	1,107	39	87	28.91	30.08	+.05	54.5	+3.3	78	27	68	28	4	41	34	44	34	56	.35	−.4	3	5.0	e.	20	ne.	20	12	10	9	4.9	.0	.0	0
Tucson [1]	2,555	5	23	27.42	30.06	.....	53.0	.....	82	27	67	27	5	39	39	43	34	54	.50	−.4	2	.....	se.	.....	.....	.....	9	16	6	4.7	.0	.0	0
Yuma	142	9	54	29.95	30.10	+.05	58.2	+3.8	80	27	70	31	3	46	36	47	34	43	.19	−.3	2	6.5	n.	20	n.	10	16	9	6	3.5	.0	.0	0
Independence	3,957	5	26	26.10	30.23	+.16	.....	.....	.....	.....	.....	.....	.....	.....	.....	32	24	...	.14	−.8	3	.....	nw.	.....	.....	.....	12	8	11	4.0	.....	.0	0
Middle Plateau							26.6	−1.1										81	0.89	−0.1									6.2			
Reno [1]	4,527	61	76	25.59	30.28	+.15	28.5	−3.1	51	25	37	−9	2	20	33	25	22	84	1.41	−.1	8	3.3	w.	24	w.	27	7	7	17	6.9	.8	.0	0
Tonopah	6,090	9	20	24.12	30.22	.....	31.2	.....	51	26	39	2	2	24	21	27	23	...	.41	.....	4	.....	se.	.....	.....	.....	11	9	11	.....	1.9	T	0
Winnemucca	4,339	5	56	25.79	30.31	+.15	25.8	−2.8	46	10	36	−11	1	16	34	24	22	84	1.36	+.3	14	5.5	ne.	19	n.	24	8	4	19	7.0	7.4	.0	0
Modena	5,473	10	46	.....	.....	.....	23.8	−2.9	54	27	35	−14	2	12	32	.....	.....	...	.33	−.5	1	6.7	w.	24	s.	27	7	14	10	5.6	5.7	.0	0
Salt Lake City [1]	4,357	86	47	25.80	30.38	+.23	20.4	.....	50	28	30	−13	6	11	32	20	19	92	1.18	+.2	9	5.1	se.	25	s.	27	6	11	14	6.8	12.6	.8	0
Grand Junction	4,602	60	68	25.55	30.24	+.18	28.4	+4.4	54	26	39	−8	5	18	29	25	18	65	.19	−.4	5	4.8	se.	19	sw.	28	13	9	9	4.8	2.0	.0	1
Northern Plateau							24.3	−4.0										88	1.27	−0.4									7.7			
Baker [2]	3,471	36	54	26.64	30.36	+.20	23.6	−1.3	44	25	31	−9	1	17	26	22	20	90	1.04	−.4	11	5.4	s.	20	s.	24	6	7	18	6.8	9.9	.1	0
Boise [1]	2,739	5	49	27.43	30.40	+.21	20.7	.....	48	26	29	−13	1	13	31	20	18	86	.98	.....	12	7.9	se.	31	se.	24	5	4	22	7.6	11.5	.0	0
Pocatello [1]	4,478	5	31	25.65	30.40	+.20	17.2	.....	52	27	27	−22	4	8	36	17	15	91	2.22	.....	15	6.3	sw.	32	sw.	8	6	6	19	6.9	16.5	3.0	0
Spokane [1]	1,929	27	42	28.22	30.35	+.23	22.6	.....	48	25	30	−7	4	16	24	23	21	88	1.24	−.9	11	3.8	e.	18	sw.	25	5	6	20	7.6	4.9	.0	0
Walla Walla	991	57	65	29.24	30.37	+.22	23.9	−8.8	55	24	28	0	5	19	38	.....	.....	...	1.36	−.6	9	3.8	s.	22	se.	31	2	2	27	9.1	10.4	.0	0
Yakima	1,076	58	67	29.15	30.34	.....	25.4	−2.0	48	25	30	2	5	20	21	24	21	83	1.43	+.1	8	3.4	s.	11	n.	7	4	3	24	8.1	5.6	.2	0
North Pacific Coast Region							41.8	+1.4										77	4.18	−2.4									7.8			
North Head	211	5	56	29.84	30.08	+.03	43.5	+1.4	57	13	48	22	1	39	22	40	34	73	8.07	−.7	18	15.6	e.	40	sw.	26	5	4	22	7.6	T	.0	0
Seattle [3]	125	90	321	30.01	30.14	+.09	42.8	+3.3	63	20	48	22	1	38	19	37	32	74	2.83	−2.1	13	6.9	se.	34	s.	25	5	5	21	7.4	1.0	.0	0
Tacoma	194	172	201	29.92	30.13	+.09	40.1	+1.3	61	21	46	19	1	34	24	.....	.....	...	3.26	−2.9	13	4.9	n.	25	s.	25	3	4	24	8.2	2.3	.0	1
Tatoosh Island	86	9	61	29.98	30.07	+.09	44.9	+3.7	59	20	48	30	7	42	11	41	35	71	4.54	−7.3	17	22.4	e.	62	e.	7	5	4	22	7.9	1.0	.0	0
Medford [1]	1,329	29	58	28.72	30.16	.....	39.8	.....	59	21	48	16	1	32	29	38	34	79	2.19	−.6	10	.....	nw.	.....	.....	.....	2	7	22	7.8	T	.0	0
Portland, Oreg. [3]	154	68	106	30.00	30.17	+.11	36.6	−2.8	56	25	40	21	1	33	16	33	29	79	4.18	−2.4	15	6.8	e.	26	se.	24	5	6	20	7.3	.5	.0	1
Roseburg	510	45	76	29.57	30.13	+.03	43.0	+1.8	63	22	50	17	1	36	31	41	38	84	4.19	−1.1	17	3.2	nw.	26	se.	24	0	7	24	8.5	T	.0	0
Middle Pacific Coast Region							49.3	+1.8										77	4.98	−0.6									7.4			
Eureka	60	72	88	30.05	30.12	+.02	50.3	+3.4	74	21	57	28	1	44	22	47	43	76	4.08	−3.0	15	6.8	se.	37	sw.	24	6	5	20	7.1	.0	.0	1
Redding [1]	722	20	34	29.38	30.16	.....	47.7	.....	74	11	55	27	3	40	34	43	36	69	6.40	−.5	13	7.5	nw.	32	s.	24	7	4	20	7.1	.0	.0	1
Sacramento [3]	66	92	115	30.09	30.16	+.04	46.4	+.6	61	26	52	29	4	41	24	44	42	85	4.68	+1.0	13	6.6	n.	35	se.	24	3	8	20	7.8	.0	.0	1
San Francisco	155	112	132	29.96	30.13	+.02	51.2	+1.3	62	21	55	39	3	47	14	48	44	77	4.76	+.2	13	6.7	n.	29	se.	21	7	6	18	6.7	.0	.0	0
South Pacific Coast Region							54.5													−1.6												
Fresno [1]	327	5	35	29.80	30.18	+.08	47.3	.....	69	25	55	28	3	39	33	45	42	80	1.34	−.4	8	4.1	se.	20	nw.	15	2	5	24	8.3	.0	.0	1
Los Angeles	338	223	250	29.74	30.10	+.02	58.6	+4.0	80	10	68	40	1	49	28	49	39	54	.59	−2.5	3	6.9	ne.	26	e.	21	13	13	5	4.2	T	.0	1
San Diego [1]	87	20	55	30.01	30.10	+.03	57.7	.....	80	20	68	36	2	47	33	51	46	69	.21	−1.8	2	4.8	n.	20	sw.	1	11	8	12	5.5	.0	.0	0
West Indies																																
San Juan, P. R.	82	10	54	29.93	30.02	.....	76.7	+1.6	87	22	82	67	31	72	18	.....	.....	...	6.80	+2.6	21	11.0	e.	34	nw.	23	3	21	7	5.7	.0	.0	2
Panama Canal																																
Balboa Heights	118	6	92	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	•	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cristobal	36	6	97	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Alaska																																
Fairbanks	84	11	87	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Juneau	80	96	116	.....	29.84	.....	38.0	+.6	49	10	43	25	4	33	....	36	34	86	10.55	+3.4	23	8.0	w.	28	se.	12	3	1	27	....	2.5	T	0
Hawaiian Islands																																
Honolulu	38	86	100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

LATE REPORT FOR DECEMBER, 1941

Alaska																																
Anchorage	132	6	47	29.39	29.54	.....	17.8	+4.6	52	31	23	−9	8	12	25	17	15	88	.33	+0.5	6	4.9	n.	36	se.	31	10	1	20	6.8	1.5	T	..
Barrow	13	4	29	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Bethel	22	7	33	29.35	29.40	.....	12.6	+4.5	39	29	21	−2	119	4	44	13	8	75	.58	−.2	12	.....	ne.	.....	.....	.....	3	8	20	7.6	5.9	1.4	..
Fairbanks	484	11	87	29.17	29.75	.....	−8.6	−1.5	37	31	0	−44	6	−17	27	−10	−12	88	.18	−.4	5	3.1	n.	17	w.	31	6	7	18	6.8	2.7	11.3	..
Juneau	80	96	116	29.61	29.70	.....	29.5	−1.4	46	13	33	15	3	26	17	28	26	85	4.97	−2.6	20	6.3	s.	26	ne.	19	2	2	27	9.0	39.8	9.1	..
Ketchikan	75	69	85	29.69	29.70	.....	36.4	+1.3	48	5	41	22	25	32	17	34	32	84	9.35	−6.5	21	6.6	se.	26	se.	12	4	3	24	8.3	3.3	.0	..
Nome	22	25	51	29.46	29.48	.....	13.7	+6.2	35	29	20	−18	22	7	32	13	9	82	1.01	−.1	19	13.2	e.	48	ne.	13	4	4	23	8.1	10.4	14.5	..

[1] Data are airport records.
[2] Barometric data (adjusted to old city elevations) and hygrometric data from airport; otherwise city office records.
[3] Observations taken hourly.
[4] Pressure not reduced to a mean of 24 hours.
[5] Barometric data from airport records, other data from city office records.
[6] Wind, clear, partly cloudy and cloudy data from city office records, other data from airport.

NOTE—Except as indicated by notes 1, 2, 5, and 6, data in table are city office records.

445914—42——2

SEVERE LOCAL STORMS, JANUARY 1942

[Compiled by Mary O. Souder]

[The table herewith contains such data as has been received concerning severe local storms that occurred during the month. A revised list of tornadoes will appear in the United States Meteorological Yearbook]

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Conecuh County, Ala., western portion.	1	2-3 p. m.				Wind	Several houses wrecked; 1 person injured.
Ponchatoula, La., vicinity of	1	2:10 a. m.	880			do	House damaged; much timber ruined.
Theodore, Ala.	1	6:35 a. m.	150–200	1	$15,000	Tornado	Storm moved from south to north over a path 1 mile long; 1 person injured.
Ebro, Fla., vicinity of	1	12 noon		0		do	A house moved off its foundation and 4 other buildings demolished. 5 persons injured; path narrow and several yards long.
Nebraska	1					Blizzard	This severe storm with heavy snow swept the south-central and eastern portions of the State.
Montgomery and Robertson Counties, Tenn.	1			1	25,000	Tornado	Storm originated southeast of Clarksville and moved eastward into Robertson County. Principal damage destruction of farm buildings and damage to trees. Hail preceded the tornado, but damage was slight.
Wisconsin	1			2		Snowfall	From 10 to 19 inches of snow fell with drifts of from 4 to 5 feet. Most highways blocked with many automobiles stranded in drifts for several days. Interurban bus traffic suspended for several hours and trains delayed. The 2 deaths were due to exposure.
Amite, La.	3	6 a. m.	[1] 1		3,000	Wind	Two residences and several shacks damaged; 1 person injured.
Denham Springs, La., vicinity of, to Montpelier, La.	3	6:15 a. m.	880–2,200	1	3,000	do	Several small houses damaged. A Negro child killed and the mother and 2 brothers injured when a tree fell on their home.
Tennessee	3–4			4		Snow	In addition to the persons killed, several were injured due to slippery roads and highways.
West Virginia	3–4					Snow and sleet	Practically the entire State was covered with from 2 to 9 inches of snow. Sleet in Clarksburg and Weston areas somewhat delayed traffic.
North Head, Wash., and vicinity.	7				5,000	Ice	This storm occurred in the Columbia Basin of southwest Washington with considerable damage to communication and power lines and caused the disorganization of transportation. In some cases the glaze accumulated to the thickness of ¾ of an inch and remained for several days. Amount given, estimated damage for North Head and vicinity only.
Dothan, Ala.	27	11:15–12 noon			2,500	Wind and hail	Principal damage to windows, roofs, and neon signs.
Bristol, Tex., and vicinity [2]	30			7		Tornado	1 person injured; no details.
Longview, Tex.[2]	30					Wind	3 persons injured; several houses damaged.
Tyler, Tex.[2]	30				40,000	Thundersquall	2.75 inches of rain recorded. An oil refinery burned after being struck by lightning.
Bokoshe, Okla.	30	12:50 p. m.	100	0	3,000	Tornado	Telephone and telegraph lines down; several houses damaged; a number of plate glass windows in the business area broken. The funnel cloud did not reach the ground, but remained from 25 to 50 feet above; path 100 yards long.
Dothan, Ala.	31	2:30 a. m.	1,000	0	7,000	Tornado	Storm moved from the southwest to the northeast; 1 person injured; path 6 miles long.

[1] Miles instead of yards. [2] From press reports.

SOLAR RADIATION AND SUNSPOT DATA FOR JANUARY 1942

[Solar Radiation Investigations Section, I. F. HAND in charge]

SOLAR RADIATION OBSERVATIONS

BY ELIDIA F. TIMMINS

Measurements of solar radiant energy received at the surface of the earth are made at 9 stations maintained by the Weather Bureau and at 11 cooperating stations maintained by other institutions. The intensity of the total radiation from sun and sky on a horizontal surface is continuously recorded (from sunrise to sunset) at all these stations by self-registering instruments; pyrheliometric measurements of the intensity of direct solar radiation at normal incidence are made at frequent intervals on clear days at three Weather Bureau stations (Madison, Wis., Lincoln, Nebr., and Albuquerque, N. Mex.), and at the Blue Hill Observatory at Harvard University.

The geographic coordinates of the stations, descriptions of the instrumental equipment, station exposures, and methods of observation, together with summaries of the data obtained, up to the end of 1939, are given in the MONTHLY WEATHER REVIEW for December 1937, April 1941, and September 1941.

Table 1 contains the measurements of the intensity of direct solar radiation at normal incidence, with means and their departures from normal (means based on less than 3 values are in prentheses). At Lincoln, Madison, Albuquerque, and Blue Hill the observations are obtained with a recording thermopile, checked by observations with a Smithsonian silver-disk pyrheliometer at Blue Hill. The table also gives vapor pressures at 7:30 a. m. and at 1:30 p. m. (75th meridian time, E. S. T.).

Table 2 contains the daily total amounts of radiation received on a horizontal surface from both sun and sky for all stations except Fairbanks, Alaska; and also the weekly means, their departures from normal and the accumulated departures since the beginning of the year. The values at most of the stations are obtained from the Eppley pyrheliometer recording either on a microammeter or a potentiometer. If the daily figures for total solar and sky radiation at Fairbanks should be desired, they may be obtained approximately 2 months after the date of the observation by writing to the Solar Radiation Investigations Supervisory Station, Blue Hill Observatory, Milton, Mass.

Table 3 gives information about the solar radiation stations which are maintained by, or cooperate with, the Weather Bureau.

Total solar and sky radiation received on a horizontal surface during January was above normal at all stations with the exception of Lincoln, Fairbanks, La Jolla, Riverside, Blue Hill, Newport and Twin Falls; the last-named was exactly normal.

Radiation at normal incidence during January was close to normal at Lincoln and slightly below normal at Madison and Blue Hill.

Early in January an Eppley 10-junction total solar-and-sky-radiation pyrheliometer and a Leeds and Northrup micromax potentiometric recorder were installed at the Airport Office of the Weather Bureau in Nashville; latitude 36°07′ North, longitude 86°41′ West and altitude 602 feet. While Nashville has considerable smoke overhanging the immediate and nearby areas, the addition of this station to our solar network aids materially in rounding out the geographical distribution of pyrheliometric stations.

TABLE 1.—*Solar radiation intensities during January 1942*

MADISON, WIS.

[Gram-calories per minute per square centimeter of normal surface]

Date	Sun's zenith distance: 7:30 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	1:30 p. m.
	75th mer. time	Air mass: A. M.				P. M.					Local mean solar time
	e.	5.0	4.0	3.0	.20	*1.0	2.0	3.0	4.0	5.0	e.
	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm.*
Jan. 2	1.19	------	------	1.22	------	1.58	------	1.24	0.99	------	0.91
Jan. 3	0.86	0.80	0.96	1.14	------	1.61	------	------	------	------	.96
Jan. 5	.41	.99	1.15	1.30	------	1.66	------	1.22	------	------	.43
Jan. 6	.51	.79	.98	1.22	------	1.60	------	------	------	------	.74
Jan. 7	.20	------	1.01	1.21	------	1.35	------	1.16	------	------	.36
Jan. 9	1.47	.88	1.07	1.25	------	1.72	------	1.34	------	------	.66
Jan. 10	.36	------	1.06	1.28	------	------	------	------	------	------	.56
Jan. 13	1.60	.90	.94	1.19	------	1.39	------	1.01	------	------	2.49
Jan. 14	3.99	------	.98	1.18	------	1.72	------	1.25	------	------	2.26
Jan. 15	2.87	------	1.01	1.22	------	1.76	------	1.03	------	------	3.81
Jan. 16	1.52	.54	.61	1.01	------	1.44	------	.99	------	------	3.30
Jan. 23	3.45	.81	1.06	1.19	------	1.48	------	1.16	------	------	4.75
Means	------	**.82**	**.98**	**1.20**	------	**1.57**	------	**1.15**	**.99**	------	------
Departures	------	**−.12**	**−.07**	**0**	------	**−.04**	------	**0**	**−.07**	------	------

LINCOLN, NEBR.

Jan. 2	0.56	------	------	------	------	------	------	1.27	1.16	1.04	0.91
Jan. 13	3.15	------	------	------	------	------	------	1.20	1.05	.88	4.75
Jan. 14	3.63	------	------	1.22	------	------	------	1.22	1.11	1.01	4.37
Jan. 15	2.74	0.90	1.01	1.16	------	------	------	------	------	------	4.17
Jan. 19	3.45	------	1.09	1.22	------	------	------	1.20	1.09	.99	4.95
Jan. 27	3.81	------	------	------	1.38	------	1.38	1.22	1.09	.99	5.16
Means	------	**(.90)**	**(1.05)**	**1.20**	**(1.38)**	------	**(1.38)**	**1.22**	**1.10**	**.98**	------
Departures	------	**−.03**	**0**	**0**	**0**	------	**+.03**	**+.03**	**+.05**	**+.05**	------

ALBUQUERQUE, N. MEX.

Jan. 3	2.06	1.12	1.21	1.31	1.48	------	1.49	------	------	------	2.16
Jan. 4	2.06	------	------	1.35	1.51	------	1.49	------	------	------	1.60
Jan. 8	2.74	------	------	------	------	------	1.40	1.18	------	------	3.81
Jan. 9	3.30	1.10	1.21	1.33	1.46	------	1.44	1.30	1.20	1.12	2.87
Jan. 10	2.62	1.10	1.26	1.33	1.48	------	------	1.33	1.24	1.12	2.87
Jan. 11	2.16	1.15	1.24	1.36	1.45	------	1.44	------	------	------	2.26
Jan. 12	2.74	------	------	------	------	------	------	1.26	------	------	2.87
Jan. 13	2.74	1.00	1.13	1.27	------	------	1.34	1.20	1.05	.93	3.99

TABLE 1.—*Solar radiation intensities during January 1942*—Con.

ALBUQUERQUE, N. MEX.—Continued

[Gram-calories per minute per square centimeter of normal surface]

Date	Sun's zenith distance: 7:30 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	1:30 p. m.
	75th mer. time	Air mass: A. M.				P. M.					Local mean solar time
	e.	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	e.
	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm.*
Jan. 16	3.00	------	------	------	------	------	------	1.18	1.06	.95	4.17
Jan. 17	4.37	------	------	------	------	------	------	1.21	1.12	1.02	4.57
Jan. 18	2.36	1.06	1.16	1.28	1.44	------	------	1.29	------	------	2.49
Jan. 19	2.74	------	------	------	------	------	------	1.22	1.10	.98	2.87
Jan. 20	2.49	------	------	------	------	------	1.41	1.24	1.09	.98	2.74
Jan. 21	1.78	1.14	------	1.36	------	------	1.46	1.34	1.20	1.09	2.26
Jan. 22	1.70	1.08	1.18	1.29	------	------	1.40	------	------	------	1.78
Jan. 23	2.74	.96	------	1.24	1.39	------	1.41	1.31	1.17	1.07	3.45
Jan. 24	3.00	1.09	1.20	1.31	1.44	------	------	------	------	------	3.30
Jan. 25	2.36	1.06	1.18	1.29	1.44	------	------	------	------	------	3.15
Jan. 31	2.26	------	------	------	------	------	------	1.25	1.17	1.05	2.49
Means	------	**1.08**	**1.20**	**1.31**	**1.45**	------	**1.43**	**1.25**	**1.14**	**1.03**	------

BLUE HILL, MASS.

Jan. 3	2.0	0.89	------	1.11	------	------	------	1.16	0.99	------	2.2
Jan. 6	1.1	.86	0.97	1.10	------	------	------	.98	.82	0.69	1.3
Jan. 7	1.0	.53	.65	------	------	------	------	------	------	------	.9
Jan. 8	.6	.96	------	------	------	------	------	------	1.06	.95	.6
Jan. 11	.6	------	.94	------	------	------	------	------	------	------	1.9
Jan. 12	1.2	.87	.99	------	------	------	------	------	.79	.61	2.1
Jan. 13	2.3	.94	------	1.25	------	------	------	1.24	1.14	1.06	1.3
Jan. 14	1.3	------	------	.98	------	------	------	------	------	------	3.6
Jan. 15	2.3	------	------	1.11	------	------	------	------	------	------	2.5
Jan. 16	1.4	1.02	------	1.28	------	------	------	1.22	1.07	1.01	.9
Jan. 17	.7	.99	1.10	1.24	------	------	------	1.22	1.07	.95	1.3
Jan. 18	2.6	------	------	------	------	------	------	.84	------	------	3.3
Jan. 21	3.2	------	------	------	------	------	------	------	1.02	.98	2.6
Jan. 22	2.1	------	------	------	------	------	------	1.26	1.02	.91	1.9
Jan. 24	4.4	.92	.97	1.04	------	------	------	1.02	.93	.80	3.8
Jan. 27	2.9	------	------	------	------	------	------	.77	.63	.55	3.8
Jan. 29	1.4	------	1.10	------	1.38	------	1.38	1.25	1.12	1.01	1.2
Jan. 30	.7	1.04	1.14	1.22	------	------	------	1.04	.96	.86	1.1
Means	------	**0.90**	**0.98**	**1.15**	**(1.38)**	------	**(1.38)**	**1.09**	**0.97**	**0.87**	------
Departures	------	**−.05**	**−.05**	**0**	**+.07**	------	**+.05**	**−.07**	**−.06**	**−.05**	------

* Extrapolated.

TABLE 2.—*Average daily totals and weekly means of solar radiation (direct and diffuse) received on a horizontal surface*

[Gram-calories per square centimeter]

Date	Washington	Madison	Lincoln	Chicago	New York	Fresno	Albuquerque	Fairbanks	Cambridge	Nashville	Twin Falls	La Jolla	New Orleans	Riverside	Blue Hill	Friday Harbor	Ithaca	Newport	State College
	cal.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
Jan. 1	25	18	106	4	43	139	210	------	76	------	179	148	192	98	94	103	43	82	6
Jan. 2	198	210	204	175	143	216	276	------	69	------	135	306	243	296	63	26	52	79	84
Jan. 3	147	200	137	141	104	245	292	------	199	------	192	280	64	246	214	150	162	207	95
Jan. 4	98	226	197	169	21	264	309	------	30	------	165	288	88	273	30	153	40	37	48
Jan. 5	85	218	205	202	118	104	273	------	101	------	185	120	154	184	89	159	196	96	171
Jan. 6	257	218	207	204	188	212	176	------	201	------	170	274	335	275	215	108	209	221	146
Jan. 7	103	198	199	159	99	162	296	------	181	------	100	292	78	236	192	18	162	133	162
Mean	130	184	179	151	111	192	262	5	122	------	107	244	165	230	128	102	123	122	109
Jan. 8	238	227	84	182	218	100	294	------	223	------	167	199	348	243	231	53	252	238	195
Jan. 9	112	232	189	82	79	118	317	------	172	------	164	287	12	288	153	11	120	120	157
Jan. 10	176	217	175	208	160	87	316	------	83	------	154	280	338	282	99	88	170	67	230
Jan. 11	195	181	155	188	73	58	310	------	119	------	232	284	322	214	127	55	185	105	149
Jan. 12	247	137	193	33	150	36	288	------	162	------	230	285	372	258	181	54	98	182	193
Jan. 13	264	217	184	197	238	43	------	------	244	------	90	221	350	280	251	153	220	257	232
Jan. 14	241	227	192	148	157	154	------	------	192	------	178	301	351	248	206	148	133	205	186
Mean	211	205	167	148	153	85	305	10	171	------	173	265	299	259	175	80	168	168	192
Jan. 15	271	230	187	205	174	161	------	------	152	244	239	295	284	281	172	75	65	178	138
Jan. 16	298	238	138	188	252	92	------	------	246	261	101	294	306	286	251	44	167	262	265
Jan. 17	267	83	44	124	186	86	------	------	245	269	215	264	314	286	260	53	246	256	227
Jan. 18	------	28	138	39	134	278	------	------	188	158	213	214	318	216	196	83	52	207	160
Jan. 19	60	154	209	74	24	273	------	------	27	71	221	328	394	317	31	174	38	67	38
Jan. 20	200	162	141	138	217	294	------	------	156	255	280	322	317	316	157	132	83	184	49
Jan. 21	117	129	181	107	223	120	------	------	120	241	270	223	366	222	118	171	117	255	101
Mean	203	146	148	125	173	186	------	5	162	214	220	273	328	275	169	104	110	201	140
Jan. 22	231	247	197	67	215	109	------	------	208	265	219	238	381	224	270	105	74	261	142
Jan. 23	275	241	167	216	148	74	------	------	185	298	183	261	375	291	170	40	227	211	214
Jan. 24	249	106	212	105	190	39	------	------	240	274	235	228	387	210	252	71	220	244	185
Jan. 25	217	29	210	86	103	181	------	------	102	201	188	300	256	154	95	175	90	111	93
Jan. 26	42	67	98	69	11	201	------	------	69	279	158	180	338	235	60	94	20	46	11
Jan. 27	64	54	223	65	127	102	------	------	188	92	56	58	414	116	204	151	24	190	127
Jan. 28	49	57	123	58	4	266	------	------	42	36	93	336	418	319	33	185	57	13	42
Mean	161	116	176	95	114	139	------	9	148	206	162	229	367	221	155	117	102	154	116

TABLE 2.—*Average daily totals and weekly means of solar radiation (direct diffuse) received on a horizontal surface*—Continued

DEPARTURES FROM WEEKLY NORMALS

Week beginning—																		
Jan. 1	−38	+55	+8	+60	−6	+46	+28	−2	+21	.....	−43	+4	−7	−13	−12	+27	+25	−25	.....
Jan. 8	+58	+72	−12	+62	+33	−70	+27	−1	+72	.....	+15	+6	+79	+17	+19	+61	+70	+3	.....
Jan. 15	+45	−6	−40	+22	+49	+7	.....	−10	+60	.....	+47	−7	+5	−17	+5	+10	−6	+30	.....
Jan. 22	−14	−65	−47	−25	−47	−63	.....	−17	+19	.....	−19	−53	+143	−33	−30	+20	−45	−37	.....

ACCUMULATED DEPARTURES ON JAN. 28, 1942

.....	+357	+392	−637	+833	+203	−560	.....	−210	+1,204	.....	0	−350	+1,540	−322	−126	+826	+308	−203	.....

TABLE 3.—*Pyrheliometric stations*

Station	Under direction of—	N. latitude	W. longitude	Altitude	Instruments		Remarks
					Receiver	Recorder	
		° ′	° ′	*Feet*			
San Juan	U. S. Weather Bureau	18 28	66 06	85	Eppley	Modified potentiometer	Good exposure on narrow peninsula, but some interference from salt spray. Cooperation with Columbia University
New Orleans	Tulane University	29 56	90 07	100	do	L. & N. potentiometer	Good exposure; considerable cloudiness.
La Jolla	Scripps Institute of Oceanography.	32 50	117 15	85	do	Engelhard	Splendid exposure a few yards inland from Pacific Ocean. Early morning fogs prevail during part of year.
Riverside	University of California	33 58	117 28	1,051	do	do	Excellent exposure in midst of citrus fruit region.
Albuquerque	U. S. Weather Bureau	35 05	106 30	5,314	do	L. & N. potentiometer	At airport; dust at times. Station has highest elevation of this group.
Nashville	do	36 07	86 41	602	do	do	At airport with good exposure, but records vitiated by soft-coal smoke in winter.
Fresno	do	36 43	119 49	330	do	do	Good exposure at airport northern edge of city. The San Joaquin Valley has an exceedingly high percentage of sunshine.
Washington	do	38 56	77 05	397	do	Bristol potentiometer	Good exposure on second highest point in District of Columbia. 5½ miles northwest of United States Capitol. Some vitiation from city smoke.
New York	do	40 46	73 58	180	do	Engelhard	Fair exposure at Central Park Meteorological Observatory. Values vitiated by large city atmospheric contamination.
Lincoln	do	40 50	96 45	1,225	do	L. & N. potentiometer	Results very representative of the Great Plains area. Some dust.
Newport	Eppley Laboratory	41 30	71 19	52	do	do	Excellent location.
Chicago	U. S. Weather Bbreau	41 47	87 25	688	do	Engelhard	Good exposure on roof of Rosenwald Hall, University of Chicago. A great deal of smoke.
Blue Hill	Harvard University	42 13	71 07	640	do	Engelhard and L. & N. potentiometer.	Excellent exposure on high ridge 10 miles south of Boston. With northerly component winds, some smoke contamination from Boston.
Cambridge	Massachusetts Institute of Technology.	42 22	71 06	31	do	L. & N. potentiometer	Data used in studies of direct utilization of solar radiation for house heating under Cabot Fund.
Ithaca	Cornell University	42 27	76 29	953	do	do	Splendid site; data used by School of Agriculture.
Twin Falls	U. S. Bureau of Entomology	42 29	114 25	4,300	do	Engelhard	Good exposure on high plateau in rich farming country. Greatest elevation of any station here listed; exceeded only by Albuquerque where observations were recently begun.
Madison	U. S. W. B	43 05	89 23	974	do	L. & N. potentiometer	Excellent exposure, North Hall, University of Wisconsin. Rapid growth of city has added to atmospheric vitiation recently.
Bismarck	do	46 47	100 48	1,664	do	do	To be opened this Spring. Bismarck is one of the clearest of the northerly United States cities.
Friday Harbor	University of Washington	48 32	123 01	15	do	Engelhard	Good exposure 50 miles northwest of Seattle directly on ocean: considerable fog interference.
Fairbanks State College.	U. S. W. B	64 52	147 39	500	do	do	Most northerly station of this kind in the world. Very little artificial contamination.
	U. S. W. B	40 48	77 52	1,280	do	L. & N. potentiometer	Splendid exposure in farming country.

POSITIONS, AREAS, AND COUNTS OF SUNSPOTS FOR JANUARY 1942

[Communicated by Capt. J. F. Hellweg, U. S. Navy (Ret.), Superintendent, U. S. Naval Observatory.] All measurements and spot counts were made at the Naval Observatory from plates taken at the observatories indicated. Difference in longitude is measured from the central meridian, positive toward the west. Latitude is positive toward the north. Areas are corrected for foreshortening and expressed in millionths of Sun's hemisphere. For each day, under longitude, latitude, area of spot or group, and spot count, are included assumed longitude of center of the disk, assumed latitude of center of the disk, total area of spots and groups, and total spot count

Date	Eastern standard time	Mount Wilson group No.	Heliographic				Area of spot or group	Spot count	Plate quality	Observatory
			Difference in longitude	Longitude	Latitude	Distance from center of disk				
1942	*h m*		°	°	°	°				
Jan. 2	12 42	7351	−75	153	−11	75	194	3	F	U. S. Naval.
		7350	−53	175	+8	54	73	1		
		7349	−29	199	−11	30	12	2		
		7349	−24	204	−8	25	12	2		
		7347	+68	296	−8	68	73	3		
				(228)	(−3)		364	11		

POSITIONS, AREAS, AND COUNTS OF SUNSPOTS FOR JANUARY 1942—Continued

Date	Eastern standard time	Mount Wilson group No.	Heliographic				Area of spot or group	Spot count	Plate quality	Observatory
			Difference in longitude	Longitude	Latitude	Distance from center of disk				
1942	*h m*		°	°	°	°				
3	10 27	7353	−78	138	−6	78	24	1	F	Do.
		7351	−64	152	−11	64	145	7		
		7352	−60	156	−7	60	24	1		
		7350	−39	177	+8	40	73	1		
		7349	−15	201	−11	17	48	5		
				(216)	(−3)		314	15		
4	13 5	7354	−70	132	−7	70	85	1	G	Do.
		7353	−67	135	−5	67	48	5		
		7355	−66	136	−11	66	12	2		
		7351	−48	154	−11	49	170	6		
		7352	−43	159	−7	43	218	12		
		7350	−26	176	+8	28	73	9		
		7349	+2	204	−11	9	24	6		
				(202)	(−3)		630	41		

POSITIONS, AREAS, AND COUNTS OF SUNSPOTS FOR JANUARY 1942—Continued

Date	Eastern standard time	Mount Wilson group No.	Heliographic: Difference in longitude	Heliographic: Longitude	Heliographic: Latitude	Heliographic: Distance from center of disk	Area of spot or group	Spot count	Plate quality	Observatory
1939	h m		°	°	°	°				
5	13 23	7356	−75	113	−13	75	48	4	G	Do.
		7354	−57	131	−7	57	61	1		
		7353	−52	136	−5	52	24	2		
		7355	−51	137	−12	51	61	6		
		7351	−35	153	−11	36	145	13		
		7352	−30	158	−7	30	194	15		
		7350	−12	176	+9	17	48	6		
				(188)	(−4)		581	47		
6	11 15	7356	−59	117	−12	59	73	4	F	Do.
		7354	−47	129	−7	47	73	2		
		7355	−39	137	−12	40	73	5		
		7353	−38	138	−5	38	97	8		
		7351	−21	155	−11	23	245	9		
		7352	−17	159	−8	18	145	8		
				(176)	(−4)		706	36		
8	12 32	7356	−30	119	−11	31	121	12	G	Mt. Wilson.
		7356	−27	122	−7	27	121	13		
		7354	−17	132	−5	17	48	1		
		7355	−10	139	−11	12	242	18		
		7353	−10	139	−5	10	97	8		
		7351	+8	157	−11	11	73	5		
		7352	+16	165	−8	17	48	4		
				(149)	(−4)		750	61		
9	11 53	7356	−20	117	−12	22	145	12	G	U. S. Naval.
		7356	−13	124	−9	14	291	18		
		7356	−10	127	−5	10	145	24		
		7354	−5	132	−5	5	36	4		
		7355	+1	138	−11	7	97	12		
		7353	+7	144	−5	8	24	3		
		7351	+20	157	−11	21	48	7		
		7357	+20	157	−7	20	12	1		
		7352	+28	165	−8	28	24	3		
				(137)	(−4)		822	84		
10	10 37	7356	−7	117	−12	11	121	13	VG	Do.
		7356	−1	123	−9	6	242	24		
		7356	+4	128	−6	4	194	30		
		7356	+5	129	−9	7	24	1		
		7354	+9	133	−6	10	24	1		
		7355	+15	139	−11	17	24	4		
		7353	+20	144	−5	20	24	6		
		7351	+34	158	−11	35	24	3		
		7357	+36	160	−7	37	6	1		
				(124)	(−4)		683	83		
11	13 31	7356	+10	119	−11	12	97	5	P	Do.
		7356	+17	126	−9	18	364	11		
		7356	+22	131	−7	23	194	25		
		7355	+28	137	−11	29	73	4		
				(109)	(−4)		728	45		
12	11 12	7356	+21	118	−11	22	24	4	VG	Do.
		7356	+27	124	−9	28	339	15		
		7356	+28	125	−5	28	24	9		
		7356	+34	131	−7	34	242	26		
		7355	+40	137	−11	40	48	8		
				(97)	(−4)		677	62		
13	11 25	7358	−80	4	+13	80	291	1	F	Do.
		7356	+35	119	−11	36	73	6		
		7356	+42	126	−9	42	339	17		
		7356	+49	133	−6	49	145	12		
		7355	+52	136	−12	52	24	4		
				(84)	(−4)		872	40		
14	10 54	7358	−68	3	+12	70	339	2	F	U. S. Naval.
		7356	+48	119	−12	49	48	3		
		7356	+54	125	−9	54	291	10		
		7356	+65	136	−4	65	121	4		
				(71)	(−4)		799	19		
15	11 7	7358	−54	4	+12	57	339	2	G	Do.
		7356	+61	119	−11	61	24	1		
		7356	+67	125	−9	67	436	5		
		7356	+79	137	−4	79	48	2		
				(58)	(−5)		847	10		

POSITIONS, AREAS, AND COUNTS OF SUNSPOTS FOR JANUARY 1942—Continued

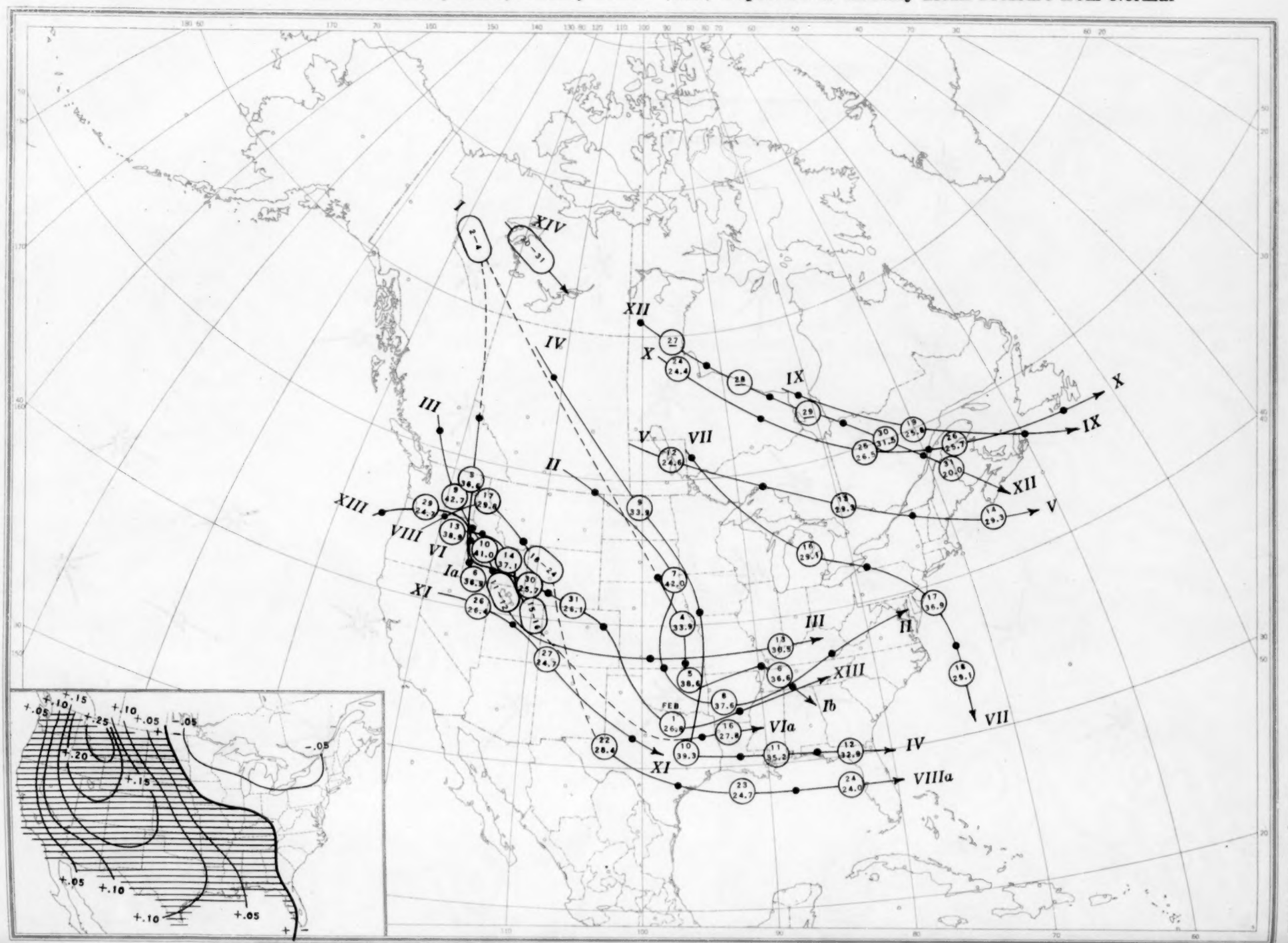
Date	Eastern standard time	Mount Wilson group No.	Heliographic: Difference in longitude	Heliographic: Longitude	Heliographic: Latitude	Heliographic: Distance from center of disk	Area of spot or group	Spot count	Plate quality	Observatory
16	h m 11 12	7358	° −40	° 5	° +12	° 43	315	13	G	Mt. Wilson.
		7356	+81	126	−9	81	291	2		
				(45)	(−5)		606	15		
17	10 42	*	−53	339	−14	54	12	3	VG	U. S. Naval.
		7358	−27	5	+12	31	327	8		
				(32)	(−5)		339	11		
18	12 39	7359	−78	300	+13	79	97	2	G	Do.
		7358	−13	5	+12	21	242	6		
				(18)	(−5)		339	8		
19	11 10	7359	−64	301	+13	67	97	6	VG	Mt. Wilson.
		7358	−1	4	+12	17	194	1		
				(5)	(−5)		291	7		
20	11 11	7359	−51	301	+12	53	48	12	G	U. S. Naval.
		7359	−50	302	+13	52	97	1		
		7358	+12	4	+12	22	194	5		
				(352)	(−5)		339	18		
21	14 20	7359	−36	301	+12	40	24	6	G	Do.
		7359	−35	302	+13	40	73	1		
		7358	+26	3	+12	30	145	3		
				(337)	(−5)		242	10		
22	10 56	7359	−23	303	+13	30	73	6	G	Do.
		*	+35	1	+15	40	24	3		
		7358	+39	5	+12	43	97	5		
				(326)	(−5)		194	14		
23	11 43	7359	−9	303	+13	20	61	1	VG	Do.
		7360	+17	329	+10	23	133	17		
		7358	+52	4	+12	54	73	2		
				(312)	(−5)		267	20		
24	10 37	7359	+4	304	+13	18	48	1	VG	U. S. Naval.
		7360	+30	330	+11	34	170	21		
		7358	+65	5	+12	67	48	1		
				(300)	(−5)		266	23		
25	12 12	7359	+17	303	+14	26	24	3	VG	Do.
		7360	+44	330	+11	48	145	4		
		7358	+79	5	+12	80	48	1		
				(286)	(−6)		217	8		
26	13 1	*	−4	268	−4	5	12	3	G	Mt. Wilson.
		7360	+60	332	+12	62	97	2		
				(272)	(−6)		109	5		
27	13 29	7360	+78	337	+13	79	73	1	P	Do.
				(259)	(−6)		73	1		
28	11 4	7362	−86	161	−8	86	48	1	F	Do.
				(247)	(−6)		48	1		
29	11 16	7362	−72	162	−8	72	145	11	F	U. S. Naval.
				(234)	(−6)		145	11		
30	12 37	7362	−59	161	−9	59	170	7	F	Do.
		7365	+39	259	−14	40	24	2		
				(220)	(−6)		194	9		
31	11 52	7364	−79	128	−9	79	48	2	G	Mt. Wilson.
		7362	−45	162	−8	45	242	7		
				(207)	(−6)		290	9		

Mean daily area for 29 days = 439.

*=Not numbered.
VG=Very good; G=good; F=fair; P=poor.

Chart I. Departure (°F.) of the Mean Temperature from the Normal, and Wind Roses for Selected Stations, January 1942

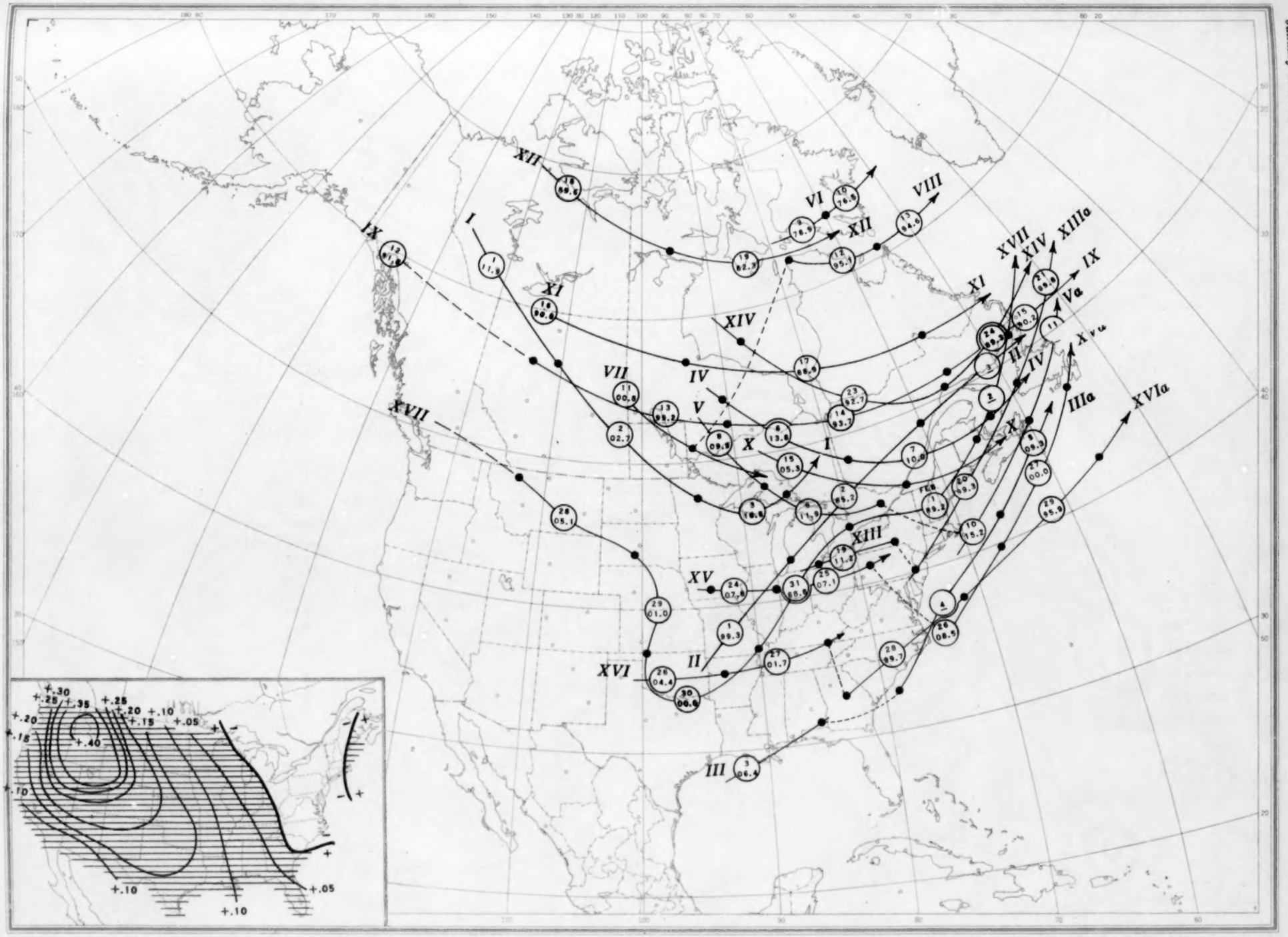
Chart II. Tracks of Centers of Anticyclones, January 1942. (Inset) **Departure of Monthly Mean Pressure from Normal**



Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 7:30 p. m. (75th meridian time).

Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 7:30 p. m. (75th meridian time).

Chart III. Tracks of Centers of Cyclones, January 1942. (Inset) Change in Mean Pressure from Preceding Month



Circle indicates position of cyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of cyclone at 7:30 p. m. (75th meridian time).

Chart IV. Percentage of Clear Sky Between Sunrise and Sunset, January 1942

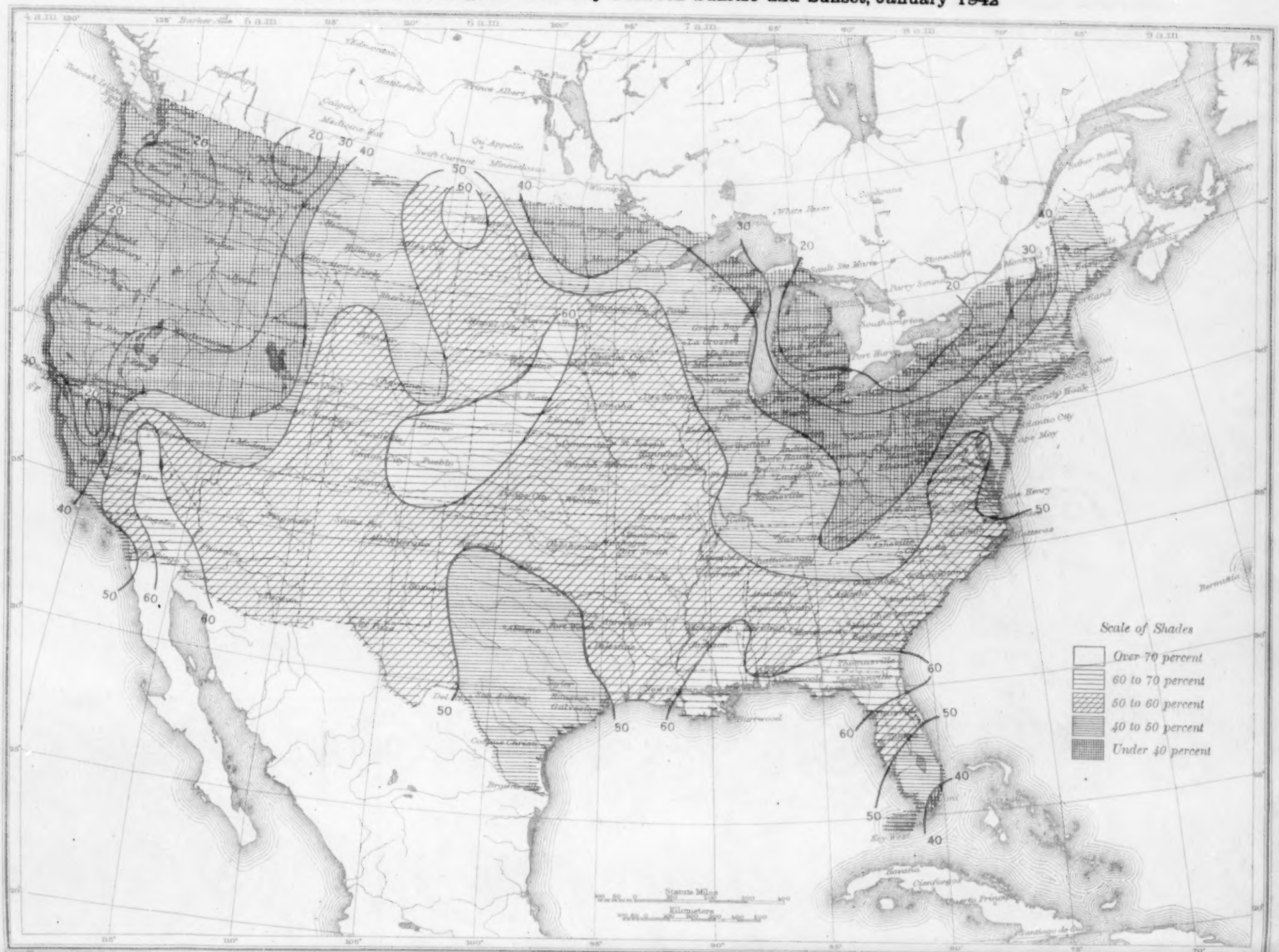


Chart V. Total Precipitation, Inches, January 1942

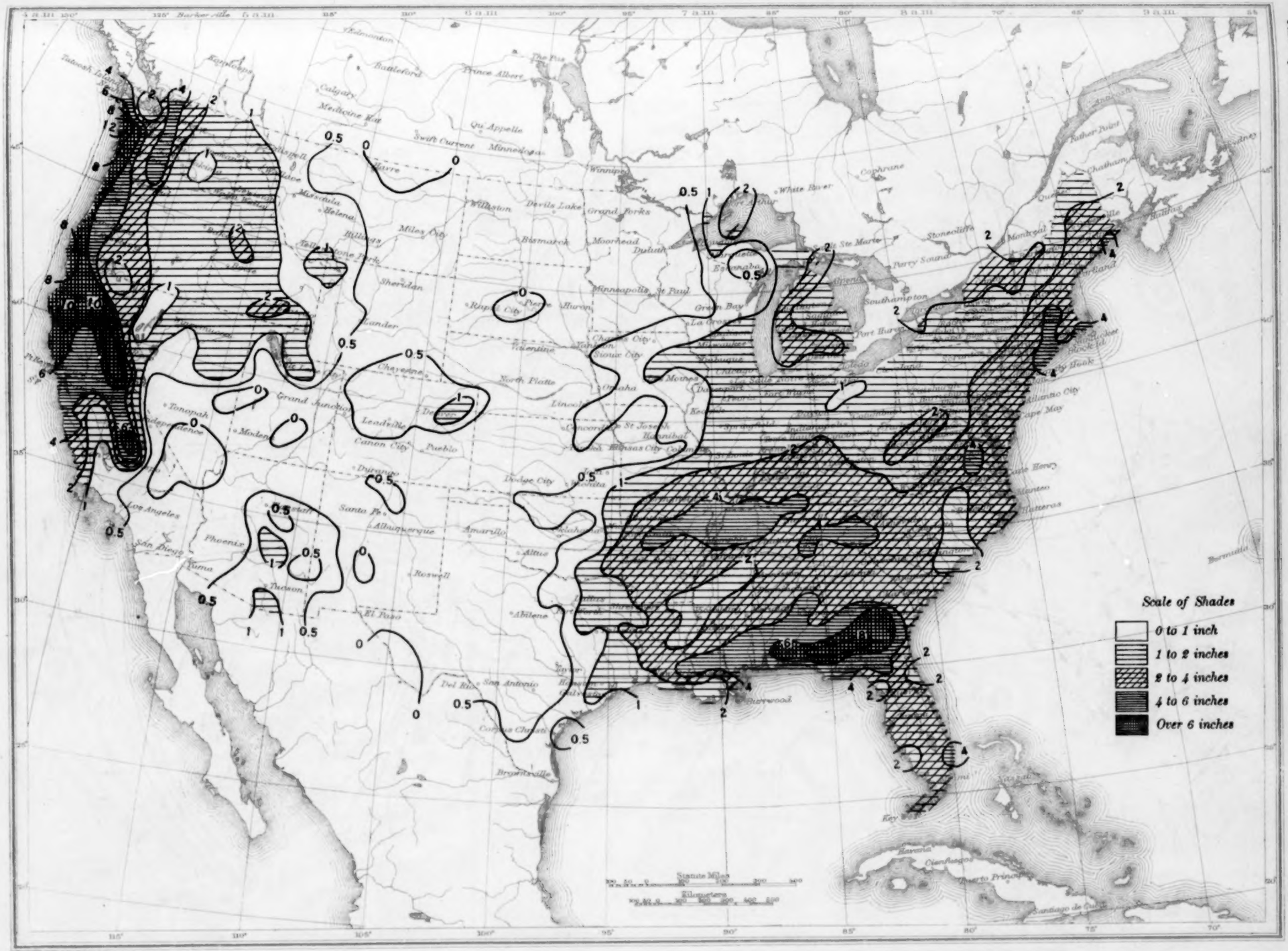


Chart IV. Percentage of Clear Sky Between Sunrise and Sunset, January 1942

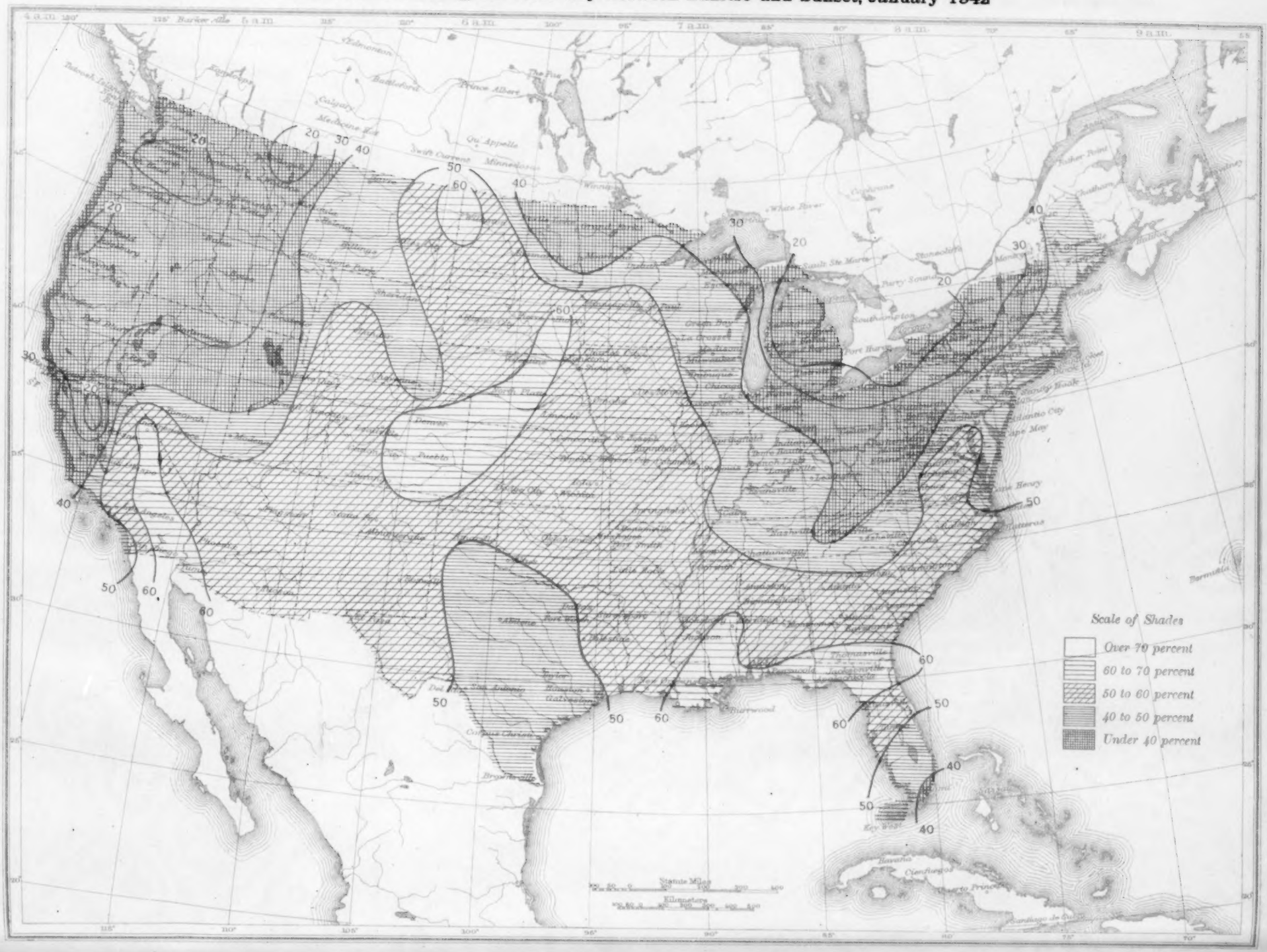


Chart V. Total Precipitation, Inches, January 1942

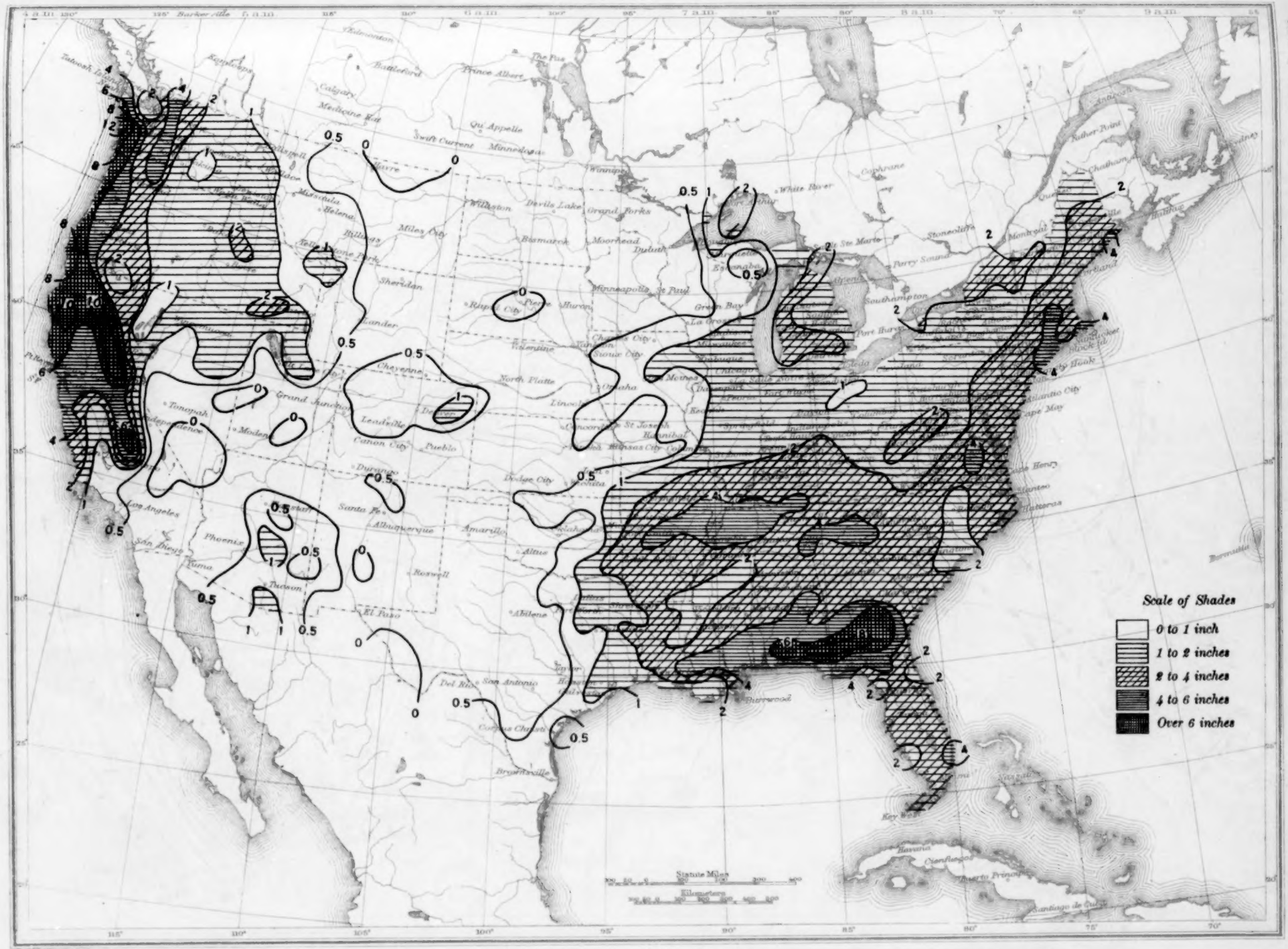


Chart VI. Isobars at Sea Level and Isotherms at Surface; Prevailing Winds, January 1942

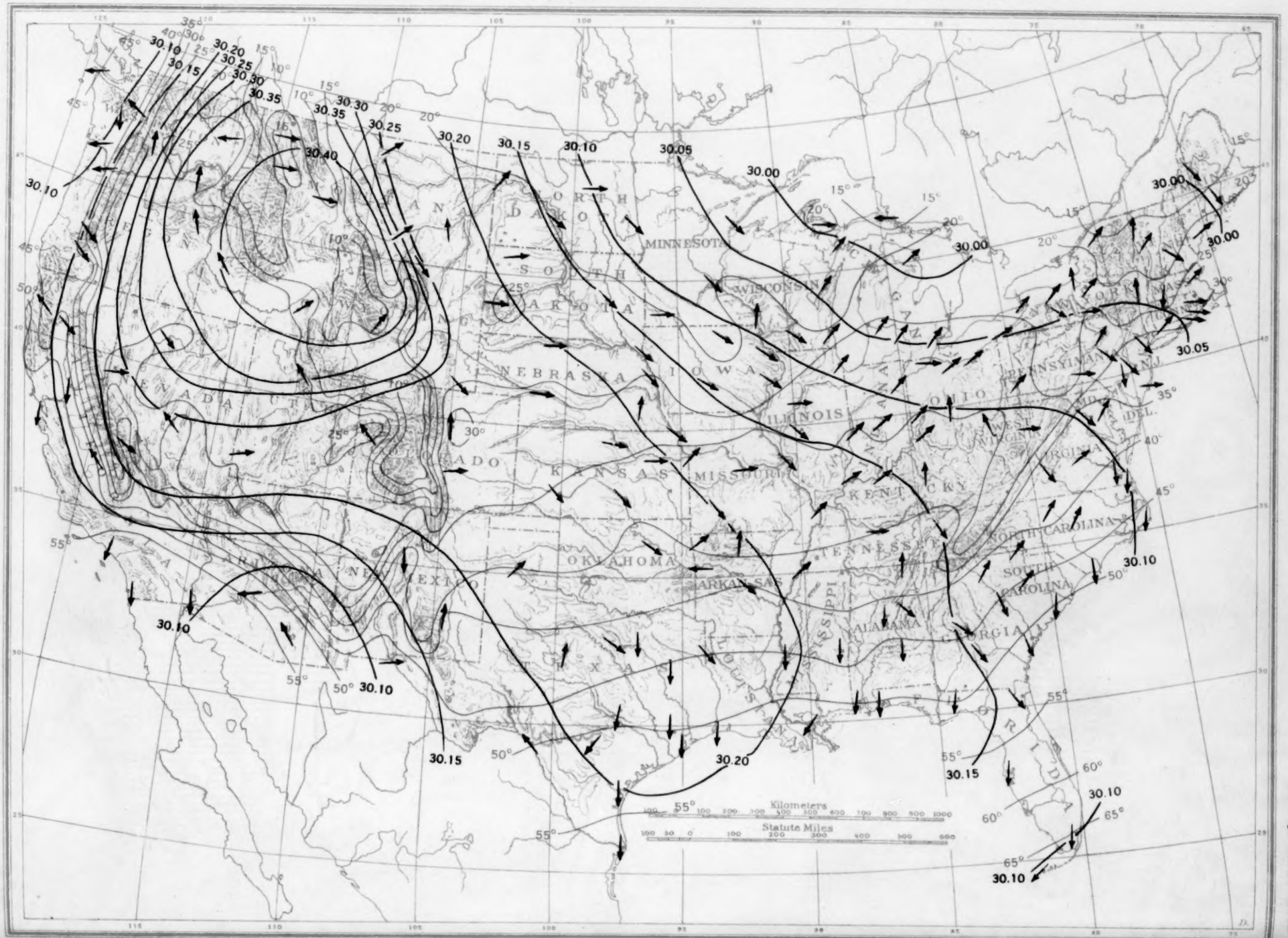


Chart VII. Total Snowfall, Inches, January 1942. (Inset) Depth of Snow on the Ground at 7:30 p.m., Monday, January 26, 1942

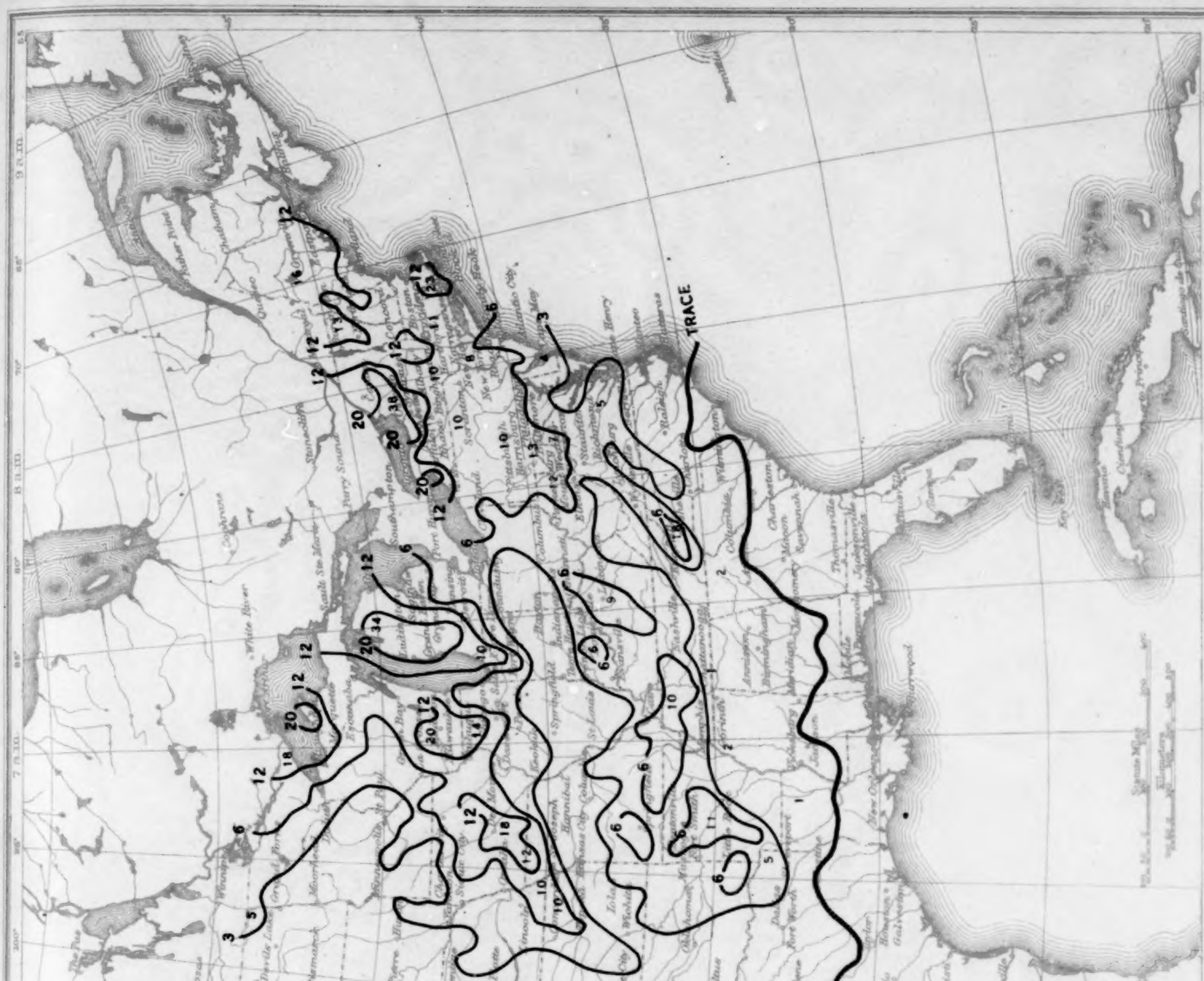


Chart XIII. Isobars (mb) for 1,524 Meters (5,000 ft.) and Isotherms (°C.) and Resultant Winds for 1,500 Meters for 0 h. January 1963

Chart VIII. Isobars (mb) for 1,524 Meters (5,000 ft.) and Isotherms (°C.) and Resultant Winds for 1,500 Meters (m. s. l.) January 1942

Isobars and isotherms based on radiosonde observations at 11:00 p. m. (E. S. T.) and winds based on pilot-balloon observations at 5:00 a. m. (E. S. T.).

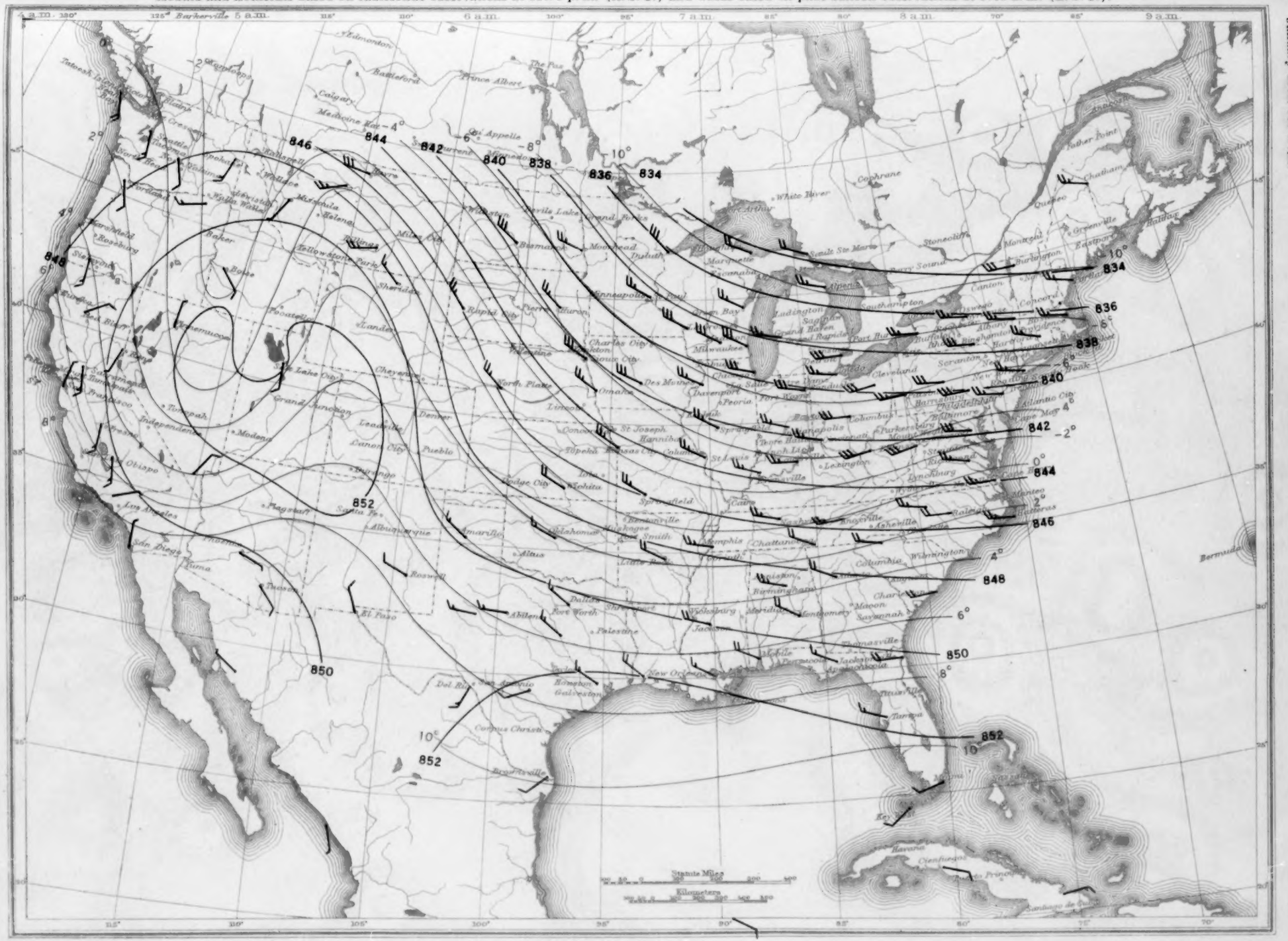


Chart IX. Isobars (mb) Isotherms (°C.) 11:00 p.m. (E.S.T) and Resultant Winds 5:00 a.m. (E.S.T.) for 3,000 Meters (m.s.l.) January 1942

Chart X. Isobars (mb) Isotherms (°C.) 11:00 p.m. (E.S.T.) and Resultant Winds 5:00 p.m. (E.S.T.) for 5,000 Meters (m.s.l.) January 1942

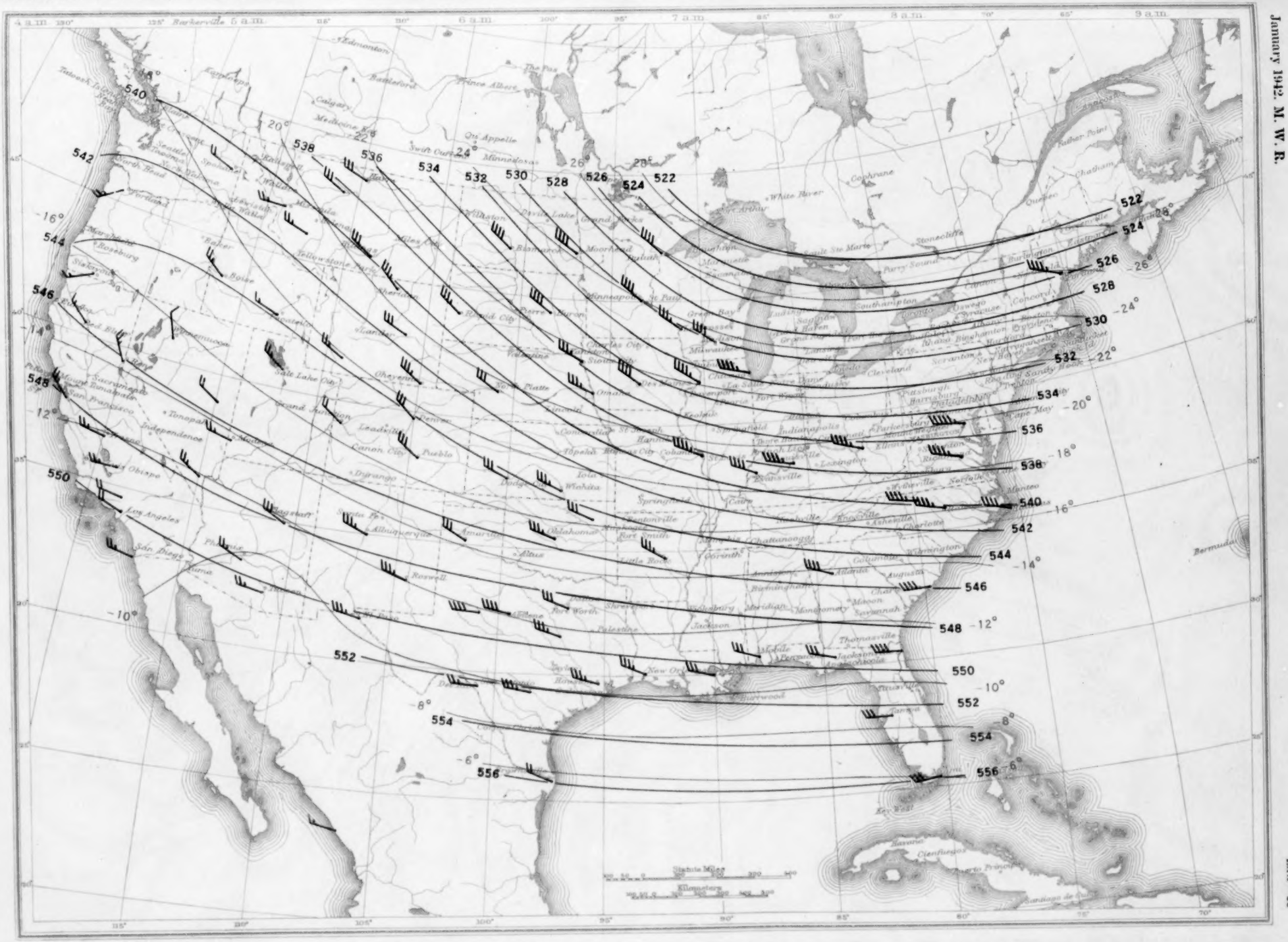
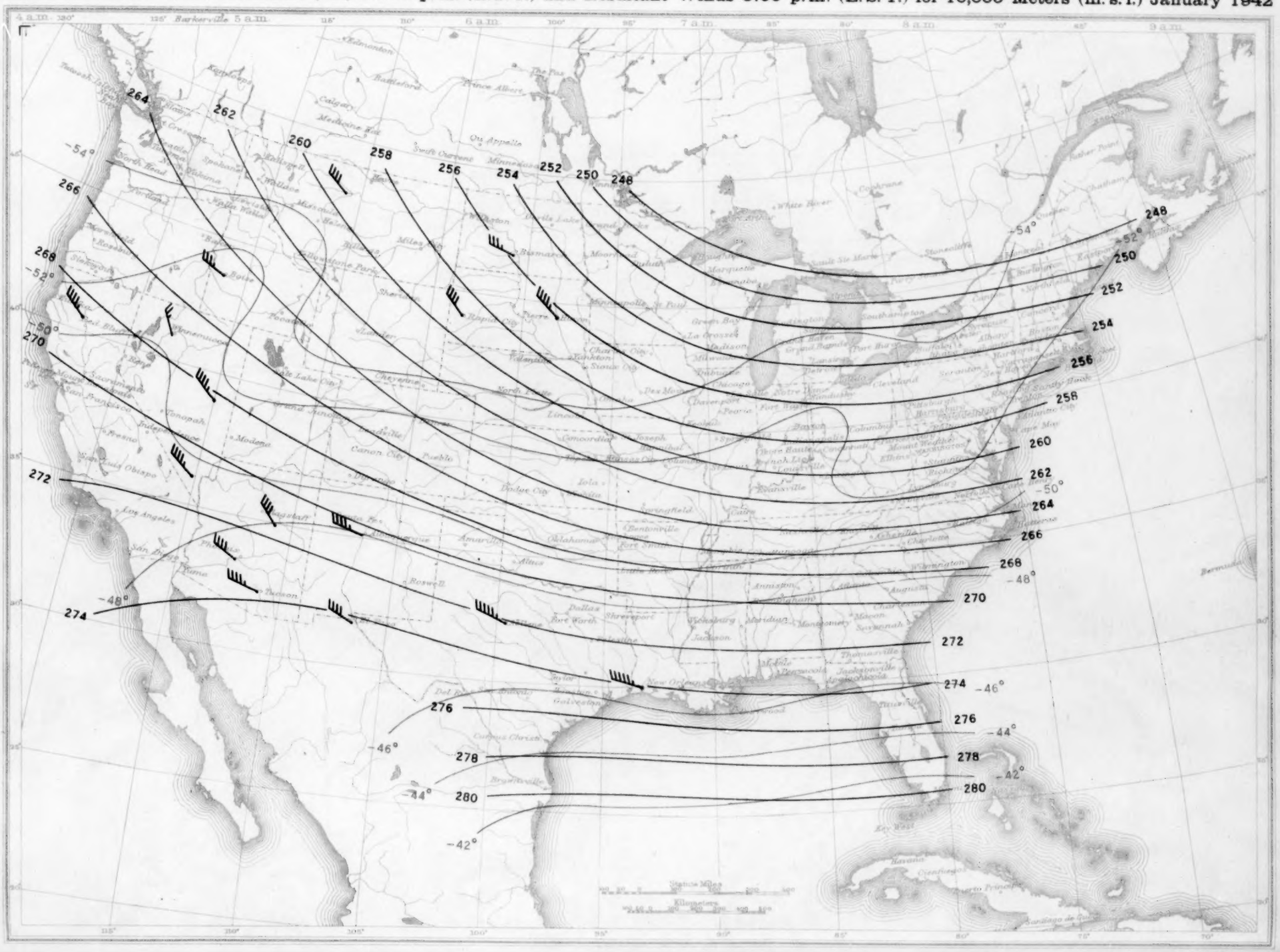



Chart XI. Isobars (mb) Isotherms (°C.) 11:00 p.m. (E.S.T.) and Resultant Winds 5:00 p.m. (E.S.T.) for 10,000 Meters (m.s.l.) January 1942